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GEOGRAPHY.

CONGRESS AND THE NORTH POLE.

AN ABSTRACT OF ARCTIC LEGISLATION IN THE CONGRESS OF THE UNITED STATES.

BY CAPT. H. W. HOWGATE, U. S. A.

III.

THE RECOVERY OF THE RESOLUTE.

The Recovery of the Resolute and the subsequent official disposition made of her, form an interesting episode in the history of Arctic adventure, the record of which appears to come properly within the scope of these articles.

The British barque Resolute was abandoned May 15th, 1854, in Wellington Inlet, by order of Sir Edward Belcher, and after a drift of over one thousand miles was picked up about the first of September, 1855, near Cape Mercy, by Capt. James Buddington, of the American whaler, "George Henry," and brought to the port of New London, as a prize. The fact of the recovery of the vessel was brought to the attention of the authorities in Washington, and resulted in its purchase by the government and presentation to the British government as an act of high international courtesy. The story is fully told in the official proceedings which follow. It is noteworthy that the first man to board the Resolute from the George Henry, was Capt. Geo. E. Tyson, then serving on the latter vessel as

"boat-steerer," but since identified with the cruise of the Polaris, the extraordinary ice-drift of one hundred and ninety-eight days, and the recent voyage of the Florence, as a member of the Preliminary Arctic Expedition of 1877.

CONGRESSIONAL ACTION.

IN SENATE, June 10, 1856 —Mr. Foster, of Conn., offered a resolution instructing the Committee on Commerce to inquire into the expediency of authorizing the Secretary of the Treasury to issue a register to the British-built barque, "Resolute," found derelict, near Cumberland Inlet, in the Arctic ocean, by the officers and crew of the American whaling ship George Henry, of New London, Conn., and by said salvors brought into the port of New London all claim to said vessel by the British government, having been relinquished to the salvors. Mr. Foster stated that this barque was one of a squadron sent out by the English government to the Arctic ocean in search of Sir John Franklin, and was abandoned by the officers and crew belonging to her, in Wellington Inlet. Eighteen months afterward she was discovered by the "George Henry" imbedded in the ice more than one thousand miles from the place where she was abandoned.

Mr. Mason, of Virginia, suggested that the proper disposition of the vessel would be for the United States to purchase her and refit her in a proper manner and send her back to England as an act of national courtesy. Whereupon Mr. Foster withdrew his resolution.

IN SENATE, June 24, 1856.

Mr. Mason, of Va., introduced a joint resolution authorizing the purchase and restoration to the British government of the ship "Resolute," late of the British Navy. Pending the consideration of the resolution, Mr. Foster, of Conn., said, "in regard to the ship there are certain circumstances that make it of peculiar value to the government of Great Britain. It is the ship that was enabled to communicate with the crew of another ship belonging to the British navy, the Investigator, which went through Behring's strait, intending to make the northwest passage in that direction by sailing to the east, but having got locked in the ice, remained for two years in the bay of Mercy, I believe. While lying there, this ship—the "Resolute"—by sending a party of men across some two hundred miles or thereabouts, communicated with the Investigator and her crew, commanded by Capt. McClure, and brought those men from the Investigator eastward to where the Resolute was lying. The northwest passage was thus carried out practically by these two ships; neither, however, having completed it by passing through the water, but by the men passing through over the ice on sledges." There was no opposition, and the resolution passed unanimously.

IN THE HOUSE OF REPRESENTATIVES, Aug. 27, 1856.

Mr. Clingman called up the Senate resolution, and stating its purport and object, requested its immediate consideration. Mr. Jones called for the yeas and nays, but they were not ordered, and the resolution passed without amendment or debate in the following words:

WHEREAS, It has became known to Congress that the ship "Resolute," late

of the Navy of her Majesty, the Queen of the United Kingdom of Great Britain and Ireland, on service in the Arctic seas, in search of Sir John Franklin and the survivors of the expedition under his command, was rescued and recovered in those seas by the officers and crew of the American whaleship, the "George Henry," after the "Resolute" had been necessarily abandoned in the ice by her officers and crew, and after drifting still in the ice for more than one thousand miles from the place where so abandoned, and that the said ship "Resolute," having been brought to the United States by the salvors at great risk and peril, had been generously relinquished to them by her Majesty's government. Now, in token of the deep interest felt in the United States for the service in which her Majesty's said ship was engaged when thus necessarily abandoned, and of the sense entertained by Congress of the act of her Majesty's government in surrendering said ship to the salvors,

Be it resolved, by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States be, and he is hereby requested, to cause the said ship "Resolute," with all her armament, equipment, and the property on board when she arrived in the United States, and which has been preserved in good condition, to be purchased of her present owners, and that he send the said ship with everything pertaining to her as aforesaid, after being fully equipped at one of the navy-yards of the United States, back to England, under control of the Secretary of the Navy, with a request to her Majesty's government, that the United States may be allowed to restore the said ship "Resolute" to her Majesty's service; and for the purchase of said ship and her appurtenances, as aforesaid, the sum of forty thousand dollars, or so much thereof as may be required, is hereby appropriated, to be paid out of any money in the treasury not otherwise appropriated.

The resolution received the presidential approval on the same date, Aug. 28, 1856, and on the 13th of November, the Resolute, under command of Commander Hartstene, sailed from New York Harbor for England. She arrived at Portsmouth, December 12th, and on the 16th was delivered to the Queen of Great Britain in person.

The following message from the President of the United States, transmitting copies of a correspondence growing out of the restoration of the vessel to her Brittanic Majesty's service, gives a detailed account of the official ceremonies attending the transfer.

January 20, 1857.—Laid upon the table and ordered to be printed.

To the Senate and House of Representatives:

Soon after the close of the last session of Congress, I directed steps to be taken to carry into effect the joint resolution of August 28, 1856, relative to the restoration of the ship "Resolute" to her Brittanic Majesty's service. The ship was purchased of the salvors at the sum appropriated for the purpose, and "after being fully repaired and equipped," was sent to England under control of the Secretary of the Navy. The letter from her Majesty's minister of foreign affairs now communicated to Congress in conformity with his request, and copies

of correspondence from the files of the Departments of State and of the Navy, also transmitted herewith, will apprize you of the manner in which the joint resolution has been fully executed, and show how agreeable the proceeding has been to her Majesty's government.

FRANKLIN PIERCE.

Washington, Jan. 19, 1857.

MR. DALLAS TO MR. MARCY.

(Extract.)

LEGATION OF THE UNITED STATES,
LONDON, December 19, 1856.

SIR: * * * * * * * * * * * * *

Late in the morning of Saturday, the 13th inst., your No. 36 was delivered to me by Commander Hartstene, who had that morning arrived with the barque "Resolute" at Portsmouth. I addressed the Earl of Clarendon at once in conformity with your instructions, tendering the ship to the British government with a request that the United States might be allowed to restore her to her Majesty's service. In a private note I also sought an interview with his lordship, in order to arrange whatever formalities the proceeding might require. He was out of town, but on Monday I received a note from him saying he would return to London, and be happy to see me at three o'clock on Tuesday the 16th inst. Our conference was an entirely agreeable one; his lordship characterizing the restoration of the "Resolute" as an act of national courtesy, wholly unprecedented, and which could not fail to have the most beneficial influence upon the relations of the two countries. As I desired to put Capt. Hartstene in communication with the admiralty, I made inquiries about Sir Charles Wood, and was informed by his lordship that he was probably at his country residence, but should be immediately apprized of my wishes, and would, no doubt, come to the city without delay. At about nine o'clock that night (Tuesday) I received the reply of her Majesty's principal Secretary of State for foreign affairs to my offering letter of the 13th. Copies of these communications accompany this despatch * *

* * * * * * * *

I have the honor to be
Your most obedient servant,

Hon. W. L. MARCY, Sec. of State. G. M. DALLAS.

MR. DALLAS TO THE EARL OF CLARENDON.

LEGATION OF THE UNITED STATES,
LONDON, Dec. 13, 1856.

MY LORD:—The barque Resolute under the command of Commander Hartstene, of the United States Navy, having reached Portsmouth, I beg leave briefly to invoke your lordship's attention to the cause and object of her arrival.

It will be recollected that this vessel formerly belonged to her Majesty's navy, and had been employed on a perilous service which enlisted the co-operative sympathies and exertions of the American government and people. The officers and crew, after gallantly enduring prolonged suffering, left her inextrica-

bly imbedded, as they had just reason to believe, in the ice of the arctic region. She was, however, about two years afterwards, discovered adrift, more than twelve hundred miles from the place at which she had been abandoned, and was taken by certain American seamen to their own country. All claim to recover and repossess her was generously waived by her Majesty's government in favor of those by whom she had been rescued.

The Senate and House of Representatives of the United States in their late session, expressed by a joint resolution, the sincere disposition and purpose of the nation on this subject, and I have the honor to place before your lordship a duly authenticated copy of that act. I am now specially instructed by the President, while conveying to your lordship the assurance of his cordial gratification in directing such a measure of comity to a friendly power, to fulfill the congressional injunction by tendering the barque Resolute to her Majesty's government, and by requesting that the United States may be allowed to restore that vessel, with all her armament, equipment and property, preserved in good condition, to her Majesty's service. Seizing an occasion so agreeable personally, to renew the expression of my highest consideration.

I have the honor to be, your lordship's
Most obedient servant,
G. M. DALLAS.

To the Right Hon. EARL OF CLARENDON.

THE EARL OF CLARENDON TO MR. DALLAS.

FOREIGN OFFICE, Dec. 17, 1856.

SIR:—I have the honor to acknowledge the receipt of your letter of the 13th inst., announcing to us the arrival of the barque "Resolute" at Portsmouth, under the command of Captain Hartstene of the United States Navy. That after having been unavoidably abandoned in the ice while employed in the service of her Majesty on an expedition in the arctic seas, in search of Sir John Franklin, she was discovered two years afterward adrift, more than twelve hundred miles from the place where she was abandoned and was taken to the United States by American seamen, in whose favor her Majesty's government relinquished all claim to the ship. Under these circumstances the Senate and House of Representatives of the United States, by a joint resolution, of which you transmit to me a certified copy, authorized the President of the United States to purchase the "Resolute" of her salvors, with all her armament, equipment and the property on board of her when she arrived in the United States, and to cause the ship with everything belonging to her, after being fully repaired at one of the Navy yards of the United States, to be sent back to England in order to be restored to her Majesty's service, as a testimony of the deep interest felt in the United States for the service in which the ship was engaged when she was necessarily abandoned.

I have not failed to lay your letter and its enclosures before the Queen, and I have received her Majesty's commands to acquaint you that she gratefully accepts the offer thus made of the restoration of the "Resolute" to her service.

I beg to assure you that the friendly feeling on the part of the Senate and House of Representatives which prompted this measure, and the generous and complete manner in which it has been carried into effect by the President and his government, are most highly appreciated by the Queen and rhe Majesty's government, and I am confident by the British nation at large. I request you, sir, to have the goodness to convey to the President and to request him to communicate to the Legislature of the United States, the cordial thanks of the Queen and of the British government for an act of generosity and the sympathy which will meet with a warm response in this country, and cannot fail to strengthen the kindly feelings which unite the people and governments of the two nations.

I beg to add that the Queen has signified her intention to visit the "Resolute" off Cowes, on this day, in recognition of the munificence of the Legislature and government of the United States in restoring that vessel to her Majesty's service and in compliment to the officers and crew who have brought her to this country. I avail myself of this opportunity to renew to you the assurances of the highest consideration with which I have the honor to be Sir,

Your most obedient humble servant, CLARENDON.

NAVY DEPARTMENT, November 8, 1856.

SIR:—The department has placed you in command of the "Resolute" recently fully repaired and fitted out by the United States with a view to her restoration to the British government, in pursuance of a joint resolution of Congress, approved Aug. 28, 1856. You will, so soon as she is in all respects ready for sea, proceed to England entering the port of Portsmouth. Leaving her there in charge or the officers under your command, you will proceed immediately to London in order to advise with the American minister, Hon. G. M. Dallas, to whom you will deliver the enclosed despatch from the Department of State. Accompanying these instructions you will receive an open communication from this department to Sir Charles Wood, the first lord of the Admiralty, who will, I presume, advise you as to the proper disposition of the ship in the event of her Majesty's government accepting her. You will consult freely with Mr. Dallas and will find it convenient to be guided in your movement by suggestions from one so peculiarly competent as he is.

When you have performed the duty assigned to you, you will make arrangements for the return of the officers and men, exercising all prudence and economy. Previous despatches have instructed you as to the mode of procuring funds to effect your purposes. I am, respectfully, your obedient servant,

J. C. DOBBIN.

Commander H. J. Hartstene, U. S. N.,
Commanding Barque Resolute, New York.

UNITED STATES NAVY DEPARTMENT, Washington, Nov. 8, 1856.

SIR:—This communication will be delivered to you by Commander Henry J. Hartstene, of the United States Navy, who goes to England in command of the "Resolute" under orders from his government with a view to carrying into

execution "a resolution authorizing the purchase and restoration to the British Government of the ship 'Resolute' late of the British Navy", a copy of which I have the honor to enclose herewith.

The language of the preamble and the resolution so distinctly announces the considerations which prompted their adoption and approval as to dispense with their repetition and recital on my part. This very agreeable duty is performed by me, Sir, with much pleasure. The ship has been thoroughly repaired and has on board "all her armament, equipment and property" which has been preserved in good condition. In pursuance of the resolution the President requests to her Majesty's government to allow him to restore the ship "Resolute" to her Majesty's service.

Commander Hartstene is ordered to deliver the vessel at any port and to any officer, to be designated at the pleasure of her Majesty's government.

Accept assurances of high respect, etc. etc.

J. C. DOBBIN, Sec. of the Navy.

To the Right Hon. Sir Charles Wood, Bart.
First Lord of her Brittanic Majesty's Admiralty.

LONDON, Dec. 19, 1856.

SIR:—I have the honor to inform you that after a boisterous passage we anchored at Spithead on the 12th inst., at half past two o'clock p. m., with the United States and British ensigns flying at the peak. Notwithstanding the furious gale, which was then raging, we were immediately boarded by Capt. Peale of her Brittanic Majesty's frigate Shannon, who cordially offered to us every civility and attention. In a few moments afterward a steamer arrived from Vice Admiral Sir George Seymour (commanding officer of the station), with a tender of services and congratulations on our safe arrival. Proceeding to Portsmouth next morning (which I did in a government steamer provided me for that purpose) I visited the United States consulate and was there waited upon by Sir Thomas Maitland (who has become commanding officer of the Naval station in the absence of the Admiral Sir George Seymour), and received from him a most cordial welcome with proffers of every possible service. By express instructions from the Admiralty accommodations were prepared for us at the first hotel, and orders for a bountiful supply of provisions to be sent on board the "Resolute", also a carte blanche for the railroad to London, for myself and the officers of the "Resolute." In fact nothing could exceed the kindness and courtesy with which we were treated by Capt. Sir Thomas Maitland, who seemed unwilling that any means of adding to his hearty expressions of welcome should pass unexhausted. That morning's post brought me a communication from Sir Charles Wood, first Lord of the Admiralty, (which I herewith enclose) whose expressions of kindly feeling I beg may be particularly noticed. At noon of the day after our arrival, a royal salute was fired from the "Victory" (flagship), from the fortifications and from the "Shannon" at Spithead. As soon as my official visits were made, I proceeded to London and delivered to the Hon. Mr. Dallas, Minister plenipotentiary and envoy extraordinary from the United States, the open communication committed to my

charge by the department. In London as well as in Portsmouth, I received the most cordial and pressing hospitalities; in fact scarcely an hour has elapsed without a proffer of courtesy and hospitality from the municipal corporations, military authorities, scientific associations, clubs, etc., etc., all of which I have politely declined, except an invitation to dine with Lord Palmerston, also one from Admiral Sir George Seymour and one from the municipal authorities at Portsmouth.

Her Majesty and Queen expressing a wish to visit the "Resolute" and a desire that that vessel might be taken to Cowes (near her Majesty's private palace), I immediately acceded, and the ship was towed thither by the government steamer, escorted by two other steamers and her Brittanic Majesty's steam-frigate "Retribution." On the morning of the 16th at ten o'clock a. m., her Majesty the Queen, accompanied by his Royal Highness Prince Albert, the Prince of Wales, the Princess Royal, Princess Alice and several members of the Royal household, visited the "Resolute." She was received with all honors. As her Majesty stepped on board, after being presented by Vice Admiral Sir George Seymour, K. C. B., I welcomed her, and from the impulse of the moment and in obedience to what I conceived to be of the feelings of my countrymen, I delivered the "Resolute" to her Majesty, after which I showed her Majesty all the objects of interest, connected with the vessel, with which she appeared much gratified.

On the afternoon of the same day I received from the Hon. C. B. Phipps, C. B. (keeper of her Majesty's privy purse) a note enclosing a check for £100 (one hundred pounds), with a request from her Majesty that it should be distributed among the crew, which I accepted in their behalf. I enclose the note, also a letter from the Admiral Sir George Seymour, K. C. B.

By favor of an invitation from her Majesty the Queen, I dined and spent the night at the palace of her Majesty at Osborne, where I was treated with the most distinguished attention. On the following morning (Dec. 17), the "Resolute" was towed up to the harbor of Portsmouth, escorted by her Majesty's steam-frigate "Retribution," and on arriving at her anchorage was received by another royal salute and with such an outburst of popular feeling as was never known before.

I have this day received from Sir Charles Wood, first lord of the Admiralty, an invitation (herewith enclosed) which could not be declined. I have accepted it and shall, as soon as it is agreeable to her Britannic Majesty's government, deliver up the "Resolute" and take advantage of their courteous tender of a passage to the United States. Respectfully, &c.,

H. J. HARTSTENE, Commander U. S. N.

HON. J. C. DOBBIN, Secretary U. S. Navy,
WASHINGTON, D. C,

ADMIRALTY, Dec. 12, 1856.

SIR:—I have this moment heard by telegraph that the "Resolute," which the government of the United States has in a manner so gratifying to the feelings of this country, sent over under your command, is entering Portsmouth. I hasten to assure you of the satisfaction with which I have learned of your arrival in this

country and of my anxiety to offer to yourself, your officers and crew the warmest reception in my power.

Capt. Sir Thomas Maitland, the senior officer at Portsmouth in the accidental absence of the two admirals, will, I am assured, do everything in his power to show the spirit in which we are most anxious that you should be welcomed, and when we are apprized of your wishes and intentions as to your stay in this country and return to America, we shall be happy to meet them to the utmost.

This is not a fitting opportunity for saying anything as to the munificent conduct of your government, which will be the subject of communication between the governments of our respective countries. I am wishful at present to offer to yourself and your companions, personally every civility and courtesy that the Board of Admiralty can command.

I have the honor to be, sir, your obedient and faithful servant,

CHARLES WOOD.

CAPT. HARTSTENE.

OSBORNE, Dec. 16, 1856.

MY DEAR SIR:—I have received the command of her Majesty the Queen to request that you will have the goodness to distribute amongst the ship's company, who have brought the "Resolute" to England, a hundred pounds, for which I beg to enclose a check.

Her Majesty would wish this to be considered as a personal present from herself to the crew, and I am directed to request that you will use your own discretion as to the proportions in which it is to be distributed.

I have the honor to be, my dear sir, faithfully yours,

C. B. PHIPPS.

(PRIVATE.)

ADMIRALTY HOTEL, PORTSMOUTH, Dec. 17, 1856.

MY DEAR SIR:—I have received a note from Lord Palmerston from Broadlands, his country residence, beyond Southampton, in which he says that he does not know how long you remain at Portsmouth, but if during your stay you will come over with me and dine at Broadlands, it will give Lord Palmerston great pleasure to receive us.

Will you have the kindness to enable me to reply to this invitation to-day about five o'clock, or before six.

I think you will find the visit our prime minister proposes, an agreeable manner of making his lordship's acquaintance, and if you can name a day for the purpose I shall be happy to accompany you. We can go by the railway from Portsmouth to Romsey, which is very near Broadlands.

I have received no direction about the arrangement for the transfer of the "Resolute," but I am disposed to think that less ceremony may be requisite hereafter, her Majesty's visit having conveyed a national compliment on the manner in which the vessel has been restored to this country by the United States.

I remain, dear sir, your very obedient servant,

CAPT. HARTSTENE, U. S. N. G. H. SEYMOUR.

XUM

ADMIRALTY, Dec. 18, 1856.

DEAR SIR:—I have the honor to acknowledge the receipt of your letter of this day's date, informing me of the Resolute's being in Portsmouth harbor. I have also received the letter from the Secretary of the Navy of the United States, communicating to me the resolution of Congress, in pursuance of which the Government of the United States has so liberally presented that ship to her Majesty, and sent her over to this country under your command.

I shall have the honor of addressing the Secretary of the Navy in acknowledgment of his letter.

You are good enough to say that you are ready to deliver the Resolute in any manner which may be deemed advisable, and I have only to say that orders will be given to Vice-Admiral Sir George Seymour, the commander in chief at Portsmouth, to make such arrangements for receiving her as may be most convenient to yourself, your officers and crew. It will probably render the arrangement more suitable to your wishes if you would have the goodness to communicate with him on the subject.

I have also to propose to you, that you should return to the United States in one of her majesty's ships, which I shall be ready to order on this service whenever it suits your convenience to leave this counrry, if you accept my offer. I am anxious to show by every means in my power, the sense we entertain of the generous conduct of your Government, and to offer every courtesy to yourself, officers and crew. I am anxious, also, that we should endeavor to promote the good and friendly feeling between this country and the United States, to which, on all occasions, the conduct of the Naval officers of both countries has so much contributed.

The frigate in which I propose to convey you to any point in the United States which you prefer, is ready for sea and would only require filling up with coal, but will, of course, wait for any time you may wish to spend in this country.

I have the honor to be, dear sir, your obedient and faithful servant,

CHARLES WOOD.

CAPT. HARTSTENE, U. S. N.

The following resolution allowing Commander Hartstene, Lieut. S. D. Frenchard, Master Morrison and the petty officers and crew of the steamer Vixen, to accept certain tokens of acknowledgment from the Government of Great Britain, passed both Houses of Congress, and was approved by the President, March 3d, 1857:

Resolved. By the Senate and House of Representatives of the United States of America, in Congress assembled, That Congress consents that Commander Henry Hartstene, of the United States Navy, may accept from the Government of Great Britain, a sword which has been forwarded to the Navy Department by the said Government for presentation to said Commander Hartstene, with the expression of a hope that he may be permitted to receive it as a memorial of the gratification which her Majesty, the Queen of Great Britain, has received from the return of the barque Resolute, of which said Hartstene was commander.

POLITICAL ECONOMY.

CITIZENSHIP AND ITS OBLIGATIONS.*

BY J. V. C. KARNES, KANSAS CITY.

This is an age of radicalism. All modern philosophy, whether physical or social, is intensely analytical. It is believed that every atom of matter, animate or inanimate, is the subject of inflexible government. And to ascertain and enunciate this harmonious and beautiful system of laws, is considered not only a legitimate subject of inquiry, but is claiming the attention of the best thought of modern society. Under such auspices the scientist is unfolding the mysteries of nature, and the analysis has been continued until the speculative mind has ventured the opinion that it can be carried on indefinitely, and that element after element may be evolved, constantly approaching that end where the creative will only will remain.

The sociologist has recognized in man the possibilities of a perfect being, that this is the law of his nature, and that all true progress is toward this high estate. In science it may incline toward transcendentalism, and in society may appear Utopian, but such is the direction of modern thought. Preconceived theories and speculations can offer no resistance. All creeds and philosophies and systems must submit to its crucial tests. No theological dogmas, political or social doctrines can resist its progress. Despite all fulminations the world moves. The orbit of the human mind is ever enlarging, receiving a constantly accelerated force from the recorded wisdom of the past, and only its own Creator can predict the end of its flight.

Amid such intellectual activity there has been found no more interesting field of inquiry than ourselves, individually, socially and politically considered. Men everywhere are thinking of themselves; what they are, and what they ought to be. The eye is inverted, the race is being objectively studied. Whatever may be the cause, it is a recognized fact that modern thought, political and social, as well as physical, is taking a new channel. In some way new ideas are disturbing the conservative forces of society. Men are inclined to disregard all the inculcations of experience, and to enter upon an era of uncertainty. As such subjects are so extensively engaging the public attention, it becomes a matter of duty to give earnest thought to them, and to learn more of them. Acting upon this idea it has been considered that something could be said upon the subject of citizenship, not inappropriate to this occasion. Even the limited discussion of the matter contemplated seems to require first some reference to the theory of government, and especially of our own.

*Delivered before the Alumni of Missouri University, June 4, 1878.

Society and government are not synonymous terms, although the former, in the present imperfect condition of the race, can not exist without the latter. Not to live in society is disintegration and barbarism and ultimate extinction. As has been well said, "it is in society that man first feels what he is, first becomes what he can be. In society an altogether new set of spiritual activities are evolved in him, and the old immeasurably quickened and strengthened. Society is the genial element wherein his nature first lives and grows. The solitary man were but a small portion of himself, and must continue forever folded, stunted and only half alive." But society is not a voluntary association. The social compact, so-called, is a misnomer. The great writers have often spoken of civil liberty as contradistinguished from natural liberty, assuming that there was a surrender of certain rights when the individual abandoned his condition of isolation and became a member of society. But the better doctrine is now taught that society is coeval with the human family, and the adoption of any other theory involves the supposition that there was a time when moral consciousness did not exist and men lived only as other animals, and as no one has any right to be a brute, or anything but a man, so he has no right to abjure society and lead a solitary life. Then, in the consideration of matters of this kind, it is not to be assumed that men institute society; they compose it only. This community of persons, in prescribed limits, as our civilization extends, constitute the State; as has been forcibly expressed, "the vital articulation of many individuals into a new collective individual." The society, the community, the State, cannot exist without law, and this is the initial point in the study of government. Shall the rule of action for the guidance of all be enunciated by those subject to it; shall it be self-prescribed and imposed, or shall it emanate from some source without and above? These are exactly opposite theories, and based upon opposite conclusions of human capabilities. The one is founded on the idea of individual intelligence and responsibility, that every one can of his own volition bring himself within the limitations prescribed, that he is capable of self-government; the other regards him in his animal relations, that he is insubordinate, and must be restrained by an authority foreign to himself. It does not follow that good or bad government is the necessary result of either plan. The individuals might adopt a law most vicious and destructive, while from a source remote from themselves there could exist an administration most wise and beneficent. Hence it is that of the advantages of the two systems, nothing can be definitely determined merely by historical comparisons. We know that one is based on confidence, the other on distrust, and it only displays an ignorance of our own nature to suppose this struggle for liberation will ever cease. Often in an exuberance of patriotic enthusiasm or of depression, men are heard to say that if their favorite star should disappear from the political firmament none other would ever arise and such would be the last effort at free-government. This is now considered as only rhetorical fancy. Studying the race through its successive developments, the existence of government arising from without is enti ely natural. As it began to emerge from primitive conditions, as some possessed more native cun-

ning or brute force than others, they would make claim by virtue of their inherent power to the right to rule, the principle of hero-worship drew the inferior around them, and amid this adoration the way was easy to make claim of divine right. An authority thus once established constantly fortifies itself; sometimes by wise laws and beneficent rule, with an intensated, consecrated sort of loyalty, or more frequently by the most rigid exactions of absolutism. But whatever may be the result, the relation is servile. Whether the master be kind or cruel, the single duty of the slave is perfect obedience.

The struggle everywhere, in every age, has always been toward emancipation from this thralldom. No people ever adopted a monarchy, but such is always assumed and maintained. No people ever went voluntarily into bondage. The other idea, that of democracy, is a growth, or rather a revolution, a dethronement of the false gods who had claimed divine authority, and an assertion by the State that it can take care of itself. In the darkness men are willing to be led, but with the first dawn of civilization they struggle for freedom. As the animal is subdued and the intellect developed, each individual begins to become conscious of his power to conform to law, and just so soon he grows impatient of any restraint except that of his own choosing.

Looking back upon the past and out upon the world of to-day, we see on every mountain top, lighted up by the rays of an advancing civilization, that this contest is going on. Democracy, then, is a forward movement, a step upon a higher plane, bringing every individual into immediate relations with the Source of all Power, and making him individually responsible for his conduct. Whatever may be the failures, this struggle will continue to the end of time. The nineteenth century seems to be selected as the great battle field. The railroad and telegraph, the press and school, are dissipating the shadows of superstition, and in their focal light the people are slowly but surely awaking to a realization of their situation. Every out-post of feudalism is surrendering to their demands, and they are now threatening to lay siege to that very citadel of error and wrong, the Divine Right of kings.

So steadily and persistently has this transformation gone on that to-day England, though imbedded in conservatism,

> "Where Freedom broadens slowly down
> From precedent to precedent,"

is only technically a monarchy, and the voice of the people is echoed through every part of her vast dominions. Imperial rule in France has been broken, and the people, amid much confusion, are taking their first steps in self-government. They are learning that they are not dependent for their national existence upon any Bourbon house or Napoleonic dynasty, but that they have an inherent force by which they can make and unmake kings at their pleasure. In the long contest throughout Europe between the democratic tendencies of the age and the hereditary right of kings, Russia has been the chief support of the latter; but even here Absolutism has been checked. In the slow but steady growth of the people, the nobility were reaching their giant arms to displace even royalty itself,

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and to weaken them—to level the masses and widen the distance between the crown and the subject—Alexander was driven for temporary relief to his famous expedient of emancipation. Sardinia made the first move in Italian liberation in 1849, and so rapid was the spread of the sentiment of free government, that in little more than a decade all Italy enlisted under the banner of Victor Emanuel, and with twenty millions of voices joined in the grand anthem of Universal Liberty. Even the Castilian is awaking from his dreams of pleasure as he sees his own beautiful skies lighted with the lurid glare from the volcanic fires of revolution.

The storm cloud to-day hovers over all Europe, ready to burst at any moment. Restlessness is manifest everywhere. With every shock of arms chains drop from the limbs of some enslaved people. Everywhere, in all countries, and under all conditions, the struggle is the same. To claim that any failure will prevent a repetition of the effort, only demonstrates a failure to appreciate the reasons constantly leading to these efforts. It is simply an order of growth, a deve l opment, and sometime in the future all nations will become democratic or perish in the struggle.

Our own government is the only political fabric ever constructed absolutely on the democratic idea. Educated in the strict conceptions of rank and caste, the founders of the Republic threw aside all artificial distinctions forever, and declared all men equal. The historian has said that "Not Cromwell and Hampden, not the Plebeians of Rome and the Demos of Athens, not the Republicans of Venice, nor the Calvinists of Holland or Geneva had ventured upon that tremendous stride in human progress that would alone satisfy the reformers of America." It scarcely seems probable that they were fully conscious of the immense change which their action contemplated. They asserted, unconditionally, the absolute equality of all men, the sovereignty of the people and the existence of inalienable rights, and that to secure these government is established. These doctrines, "the most heterodox of all theories to European reasons, the plainest contradictions to all the experiences of human history, they set forth distinctly and never wavered in their defense." Nothing like this had ever been known before. All other nations have gravitated toward the democratic idea, were institutional in their character, but the projectors of this new enterprise formally adopted it as the corner stone of their national edifice, an artificial result of a political theory. Well might the author of such inspired teachings be designated as the Apostle of Democracy.

From the beginning there has been a full comprehension of the philosophical idea of our system. The principle has always been understood, that the legal and political equality of man was not inconsistent with the utmost variety of natural and social distinctions, and there has been no confusion in thinking minds between the Democracy of laws and the Democracy of sentiment and of manners. Around this central idea our government has revolved through a century, ignoring birth, race, property, rank, caste or other like condition, but recognizing the full, entire, complete equality, before the law, of all men. These premises were of

such a character that there could be but one conclusion. If all were equal no one had any right to usurp the prerogative of another and thereby undertake to represent him. The law was the voice of all, and the officers selected to administer were the agents of all. This was a complete renunciation of the doctrine of government from without. The individual derived his right to participate in the affairs of the commonwealth, not from the condescension of the Crown, but from his birthright as a freeman. No political leader, whatever may be his ability or virtue, has ever attained or can ever attain any enduring fame unless he thoroughly understands and appreciates this living force in our government.

As the teachings of Christ comprehend all ethics, so the doctrines upon which this Republic was founded constitute a complete political code, and all progress that we make as a nation will be in a more strict conformity to them. We hold that all law emanates from the people, that it is simply the expression of their will, that they declare it as a rule of action, and hence we fairly conclude that all who are amenable to the law ought to be heard in its enactment. Following this process of reasoning, every move made is in the direction of enlarging the suffrage, and in following to its legitimate consequences the theory of our system. The Constitution, *as it is*, embraces in its citizenship all persons born or naturalized in the country. With every change in our naturalization laws the time of pupilage required of the foreigner has been shortened. It may be heresy to say it, but under the present educational stimulus the intellectual forces of the gentler sex cannot be much longer suppressed, and woman's voice will soon be heard either through the Sixteenth or some future amendment. We may shut our eyes to this incoming tide, but the law of our national existence will lead to this result as inevitably as the rising of the morrow's sun.

Our basis of citizenship is now much broader than in any other democracy ever attempted. The relation of the voters to the entire population is about one to five or six. In the Athenian republic, the most democratic of the Greek states, at the time when the suffrage was the most extended, there were but 21,000 persons entitled to vote out of a total population of more than 500,000, or about one in twenty-four. Sparta was still more undemocratic than Athens. The number of voters in Laconia, at the time of the Persian wars, according to Herodotus, was only 8,000, while the number of free citizens who were rigidly excluded from political power is computed to have been 16,000, exclusive of women, children and slaves. In the early part of the first century before Christ, while the Roman commonwealth was in the full height of success, when the people triumphed over the Optimates, the whole number of citizens was only 46,300, which was probably about one-fiftieth of the population of that period. In the republics, so-called, of Geneva and Venice, in the hour of the completest triumph of the Guelphs, suffrage was only a privilege dispensed to or claimed by the few for the benefit of the many. In England, even under the fierce agitation of the last quarter of a century, with Arch, and Cobden, and Bright, and Gladstone, and many other noble philanthropists, urging them forward, the people slowly extricate themselves, and even now only about one in twenty is, in any true

sense, a free man. Though France has tired of imperialism, and is enjoying the name at least of a republic, still, there is everywhere manifested a lurking distrust of the democratic principle, and the ballot box, instead of being a record of the popular will, is merely a safety valve for the escape of accumulated excitement. As a historical fact then, it can be safely asserted that never outside of our own country has the democratic principle been put to the test as the absolute basis of government. If any of the Swiss Cantons have formed an exception, the ray was so dimmed by the surrounding darkness as to have been scarcely perceptible as shown upon the pages of history. Moreover, it can be safely asserted that never before has so large a proportion of the entire population been admitted into an active participation in the making of the laws, and we may rest assured that no step will be taken backward. No human power can arrest this flood of public sentiment in this country on the matter of suffrage, and it will widen and deepen as it flows. On its surface the commune may lift its hydra-head, its waters may be crimsoned with the blood of revolution, but it will sweep onward, bearing us, either as Carlyle has predicted, over the fatal Niagara, or else out into a tranquil sea of fraternity and happiness It is idle to discuss the question of limiting the suffrage. Under the police power of the State, disfranchisement, either temporary or permanent, may be imposed as a penalty for wrong doing, or enfranchisement may be withheld from those who are the wards of the State, but if the government derives its just powers from the consent of the governed, then this is the extent of the limitation that can rightfully be imposed. As before stated, a democracy is based upon confidence that men want to do what is right, that they have an inclination and the ability to live in harmonious relation with one another, and each for himself in his own way, to work out his own destiny. What a grand conception this was. What an exalted opinion of the possibilities of the race! Such teachings are inspiration, recognizing and making known the skill of the Creative hand in the social as well as in the physical world, prescribing an orbit for each individual, and in which he may revolve with the same regularity and safety that the myriads of worlds move one about another. It is the application of divine law to human affairs, placing men in the relative position assigned each by God, teaching them that all antagonism is abnormal, a transgression, a departure somewhere. It will not be contended, however, that antagonisms will not arise. As we struggle on towards the dizzy heights of national greatness and perfection, the lightnings of fanaticism will flash, and the storms of revolution will rage, but above shines the light of eternal truth, and the philanthropist, undismayed, with full faith and unfaltering step, moves steadily onward. He realizes that "behind us, behind each one of us, lie six thousand years of human effort, human conquest; that before us is the boundless time, with its as yet uncreated and unconquered continents and El Dorados, which we, however, have to conquer and to create." For some wise purpose in the economy of nature, nothing of value is easily obtained. The beautiful world around us has been reached after the fearful convulsions of ages. Hence, social and political perturbations are no cause of alarm and despair to the critical observer of social

and political growth. In every effort made at democratic government the inciting cause of disorder has always been the same. Under such a system every individual of the State, by virtue of his membership, is placed in the vestibule of honor and power and usefulness, and whenever he is worthy he may enter. Every position in society and in the government is attainable as well by the humblest child of the commonwealth as by the child of fortune. This tempting prize is kept constantly displayed. Our Hercules is the people, and the crown of olive is the popular favor. This is a powerful stimulus to ambition, and as a result every energy of mind and body is kept constantly employed, producing restlessness and often disorder. The goal may be imaginary, the light alluring us onward a mere *ignis fatuus*, the prize valueless, but still an ambition incident to all healthy development forces us into the contest. Selfishness is still an element of our nature, and the strong will encroach upon the weak. This produces hostility and social disturbance. We have differed and are suffering from these maladies, but it is illogical to attribute them to any national decay; but they rather demonstrate that the vital forces of the system are active. The political dyspeptic may see nothing but danger, the faint-hearted may be ready to turn back, the traitor may desert his standard, but the great body of the American people are animated by the living principles proclaimed upon the morning of our independence, and have an abiding faith in their final triumph.

But although our political edifice is built on absolute truth, and its architecture in every part perfect, the work of completing and embellishing this temple devolves upon the individual members of the State. They must add to it pure lives and faithful service. This suggests at once the obligations of citizenship.

What are the duties devolving upon those who are in the enjoyment of this priceless heritage of free government? The very term citizen is full of significance. What was once the freeman of a city is now the freeman of a nation, and his influence is not even limited to its confines, but it is either "a blot, radiating to the very confines of society or a blessing, spreading benedictions over the length and breadth of the world." We no longer dwell in walled towns, the foreigner is no longer the barbarian, and the true citizen of the Republic is the citizen of the world. He is a freeman, as God made him, with capabilities and hopes and aspirations for still higher enjoyments. By the Divinity within him he realizes that his ultimate allegiance is to the Author of his being.

The citizen of the Republic is not a subject. Whatever may be the authority approving that term, it can be readily seen that it is repugnant to the whole idea of a democratic government. It is feudal in its extraction and implies subordination of the community to some extraneous power. The whole duty of the subject is loyalty. The feudal relations consisted of support, protection, maintenance on the one part and fidelity on the other. The subject was a vassal—the citizen is a sovereign.

If such, then, are the prerogatives of citizenship, what are its resulting obligations? What is the whole duty of the citizen? What is the whole law governing him? Justinian sententiously expressed it, "*Vivere honeste alterum non lædere*

suum cuique tribuere." This comprehends both individualism and the community. This two-fold relation must be kept in view in determining the obligations of the citizen, and while he is a factor in the product called government, he is none the less an independent, responsible unity. If he is, then, remanded to his normal condition of individual responsibility, the first obligation that can rest upon him is that he be self-sustaining—not a burden in any way to the State or to any other person. This requires intelligence, industry, economy. Moreover, if this independence is to be maintained, it implies the acquisition of material wealth, meaning thereby a reduction to possession of the riches provided by Nature. This store-house of food and raiment is placed within reach of the individual, and by his own efforts he is required to provide for himself and for his household. But the price to be paid is exertion—hence, he who subsists in society otherwise than by returning a full equivalent in honest toil for all he enjoys is a drone, and deserves to be expelled and driven into the misery and disgrace of his own isolation. Mr. Greeley was never more philosophical than when he said it was an unfortunate moment in the life of any man when he first conceived the idea of possessing a dollar he had not earned.

Wealth, then, in its true sense, represents industry, thrift, frugality, all the activities of both mind and body, and when lawfully acquired and kept in strict subordination, there is no more powerful agency for good. If the life-work of the citizen brings him in contact with the material world, it becomes his duty to appropriate it, to establish over it a dominion enuring to his own benefit and that of the State. Nothing is more irrational than the discussions we often hear upon this subject. In them it is maintained that the possession of property is incompatible with the highest forms of intellectual and spiritual growth. Any passion, however holy, may gain the mastery, and so industry and frugality may develop into avarice and avarice lead to dishonesty, but there can be no greater mistake than the supposition that property involves dishonesty. The enriching of one is not the impoverishing of another. All true riches come from that mine of wealth in which yielding does not impoverish. Among business men—those of the largest and most varied experience—the principle is well understood, that absolute honesty is the basis of all business activity, that as an economic measure "honesty is the best policy." Then away with all the false teachings that it is ignoble in the citizen to contribute his highest efforts to swell the material resources of the State! By honest labor mind establishes its dominion over matter, and it takes shape in all the beauties and refinements of civilization—the untamed forces of Nature are thus harnessed to the car of human progress, and, under the guidance of wise laws, the individual and the State are carried forward to still higher possibilities and enjoyments.

This contest of the individual with Nature can be and must be made in strict conformity to law. In a state of barbarism, it is by force alone that rights are asserted and maintained, while in civilized society the law affords a remedy for every wrong, and all force, save as a penalty, ought to be thoroughly eliminated. It can then be said that every form of violence, actual or inchoate, including all

the incipient steps, is a violation of one of the very first obligations of citizenship. Each can reach the utmost limit of his capacity without trespassing upon the natural domain of his neighbor, and it is his duty to do so. The world was made upon a scale sufficiently large to afford ample room for individual expansion without any wrong to another.

But to be self-sustaining, and to obey the laws, is not the whole duty of the citizen. Over all is placed the protecting shield of government, an agency of the State, and at the common expense it must be maintained. The individual is one of a community of people who constitute the State, and by them for the common good, the government is established. This expense is incurred for the benefit of all, and justice requires that each should pay in proportion to his means. This obligation is as binding as any between man and man, and wilfull evasion of it is as dishonorable as any other form of fraud. Plainly stated then, every individual is obligated to pay his proportion of the public revenue, and he who evades it by false returns, depreciated valuation, or any other popular artifice, is dishonest, and there ought to be a public sentiment that would brand him as a criminal, for he is one, actuated by the same motives and with like results. By operation of law this demand arises in favor of the State, what one evades another must pay, and to that extent he has appropriated to his own use the property of another. And he who does it deliberately and thoughtfully, under like favorable circumstances would commit any like crime. If perfection had been, or could be reached, then every one would be a perfect law unto himself. This, as before said, would be the consummation of all progress, but until it is reached government is a necessity. "If all men would practice justice, they could live together in peace without a legal code." But no ray of that millennial morn has yet tinged our horizon. Government in some form must exist, and to support it is a duty to be not only honestly discharged, but cheerfully. The complaining citizen is just so far a bad citizen, a discord, destroying the harmony of society. If evils exist that can be remedied, he ought to direct his energies to that end, or if remediless, then complaining accomplishes nothing only to infuse discontent into the general mind. These public scolds are tolerated in every community, and the only good they ever accomplish is to stimulate the inquiry as to what could have been the purpose of their creation.

In a democracy the government is the voice of its citizens, whether expressed directly or through chosen representatives. To express this voice—that is to vote—and to take an active part in all proper measures for formulating the public will, may likewise be claimed as a sacred obligation. When citizenship was bestowed, to vote was a privilege to be exercised at pleasure, but when citizenship is an inheritance an earnest participation in all political activities becomes the highest duty. "The difference is so wide between a good government and a bad one, the interests at stake are so precious, that indifference in politics becomes a crime." Many of the duties of citizenship are disagreeable. But heroism is not confined to the battle field. The conflict between virtue and vice is constantly going on, and he who would shrink is a coward. The only weapon required is an in-

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telligent, vigorous manhood. Let the voice go up from the field and from the work-shop, from the store, the office, the counting-room, from the quiet retreats of scholarly life—all blending in the harmony of beneficent government. Leave not the work to the demagogue, to the professional politician, to the selfish, sordid man, nor to the ignorant rabble. If so left, let there be no murmur when the crimson flag of revolution is unfurled and oppression, violence and disorder reign.

The battle is determined at the ballot-box, but the forces, for good or evil, are organized, armed, drilled and officered in the ward meetings, the primaries, the caucuses and conventions. These constitute the germ-cells in the political organism, from which will be developed law and order or misrule and anarchy. If the fountains of political life are thus fed by streamlets of individual influence, of what prime importance it is that the sources be pure. The highest demand of good citizenship is not intelligence, or influence, or the possession of large interests. It is not social rank, but it is the purity of personal character.

The conditions of men are largely adventitious. Success in business is often accidental. One is carried on the wave of popular favor to positions of honor without any special merit of his own, while another, more meritorious, is borne by some unfelt breeze into the storm line of misfortune and is dashed to pieces. One is born to health, another to sickness; one to genius, another to inferiority; one to fortune, another to poverty. Why this diversity exists is beyond our knowledge. But a oneness is seen only in their common similitude to the great Author of All. In this likeness consists character, this attribute alone is God-like, it is the stamp of Divinity. Reputation is a shadow, character a substance. Progress is made individually, or as a nation only as character is developed. He is a good citizen, and he only, who can stand before the mirror of his own conscience and behold a healthy, symmetrical manhood. Character knows no rank, nor station, nor condition. It dwells as often in the thatched cottage as in the gilded palace. It is manifest in the faithful servant in whatever part of the vineyard he may labor. The elevation of character attained is the only correct standard by which a judgment should be formed. It is an inward growth, a divine leaven, leavening the whole lump. In all that is grand in human nature the humblest menial if faithful to his trust, is as far above the scheming demagogue, the prating charlatan, or the canting hypocrite, however clad, as the heavens are above the earth. The good citizen is not the lawyer or doctor, the professor or the divine, the merchant or the trader, the mechanic or the artisan. Citizenship is not a profession studied or trade learned, nor is it a privilege bestowed, rather it is the attribute if humanity, and he that is a good man is a good citizen, and he that is a bad man is a bad citizen. Hence, in our pride of citizenship let us not look out upon our broad possessions, nor down from our uncertain height upon the social ladder, but rather let the eye be turned inward, let it look into all the chambers of the soul and learn if it is filled with the atmosphere of truth, lighted with intelligence and warmed with love. The obligation due to society by every individual is not that he be wise, or great or rich, but it is that he improve the

talent which God has given him. This interesting subject invites us one step farther, and we have done.

The forces of society are not all direct from the individual to the Government. The whole obligation of the citizen is not discharged merely in building up his own manhood, in sustaining himself, in helping to bear the public burdens, in the intelligent and virtuous exercise of the right of suffrage. There is a correlation of forces in society as in nature. Paradoxical as it may seem, all human progress is on the one hand toward greater individualism, and on the other toward greater mutual dependence. It is an error to suppose that these laws of development lead in opposite directions. They run parallel, and as the individual progresses every desire inconsistent with the most perfect social organization is abandoned, thus removing all cause of divergence, and in the end the highest interest of the individual, and the highest interest of the community coincide. This is the law of social organization. Every man is his brother's keeper. The welfare of each is involved in the welfare of all. It is to the interests of each to establish reciprocal relations in sympathy and in action with his fellow men. Whatever affects the community affects every member of it. Kindness, sympathy, generosity, regard for the rights of others will generate a social atmosphere so fraught with life as to force the purified blood into all the ramifications of the body politic, while selfishness, intolerance, prejudice, bigotry infuse their poisonous vapors into every department of society producing blight and decay.

In a Democratic government, the law of equal freedom is the law of the State, and every infringement of this will produce its legitimate results, and every trespass committed is a wrong done for which all must suffer. Hence it becomes a matter of importance to the citizen not only that he do right himself, but it concerns him that every other one should likewise do right. This dependence makes the conduct and business of every individual of interest to every other one. He sees "that whatever produces a diseased state in one part of the community must inevitably inflict injury upon all other parts—that his own life can become what it should be only as fast as society becomes what it should be—he becomes impressed with the salutary truth that no one can be perfectly free until all are free; that no one can be perfectly moral until all are moral; that no one can be perfectly happy until all are happy." It is the law of the universe that like produces like—society and government form no exception. If the wind be sown the whirlwind will be reaped. Virtue produces virtue; selfishness produces selfishness; love begets love; hate begets hate. He who loves nobody will be loved by nobody. He who gives nothing will receive nothing. In many cases it is difficult to trace the channels through which our conduct toward others returns upon us, but the reaction will surely come. He who would do the most for himself must do the most for others. No man can infold himself in his own individuality. "What we do is transacted on a stage of which all the universe are spectators. What we say is transmitted in echoes that will never cease. What we are is influencing and acting upon the rest of mankind." Let the citizen realize that in living for himself he is living for

others, that his obligations embrace everything that will make others happier and better, that whatever he has of influence belongs alike to himself and to the community,—whatever sphere he may occupy whether mixing with the roaring cataracts of social convulsions or mingling in the eddies of domestic life, let him realize that it is his duty to contribute of his time and enegies to the public good, to strengthen the weak, lift up the down-trodden and encourage the faltering so that the whole army of civilization may move in one unbroken column. This may be an ideal and impossible state of being, yet even the goal toward which our actual state of being strives, which is the more perfect the nearer it can approach. The true citizen of the Republic is the the perfect man, loving the Lord God with all his heart, and with all his soul, and with all his strength and his neighbor as himself.

NATURAL HISTORY.

PECULIARITIES OF OUR ORNITHOLOGY.

BY ERMINE CASE, JR., KANSAS CITY.

Science is but observation tabulated. The observer need not necessarily be a scientist. If he be a faithful reporter his contributions may be as valuable to science as the technical collator's tables. The lovers of nature and the sportsmen have been in all times invaluable assistants to the specialists. As the literature of science becomes less technical and more popular in its character, thousands of observers are added to the army which is marching upon the rocks, charging upon the herbage and flanking the animal kingdom—compelling their secrets for the use of the laboratory and the museum. The alchemist has disappeared. The crucible he used to turn dross into gold is now presided over by the quiet, earnest man, looking only for truth. The unscientific observer should not preface his report with an essay, so we proceed.

The district included within a radius of one hundred miles from Kansas City is similar, in the respects we shall mention, to the remainder of the central Missouri valley. There exist in this region peculiarities in the habits of birds well worthy of record. There also exist here many species of birds whose habitat has been placed in distant latitudes containing conditions of climate, atmosphere, etc., very different from ours, and it is very strange that so little has been said of the many marked peculiarities in this field. But it is not the object of this paper to note all the differences which have been observed, but only to suggest the subject by some well defined instances.

The common quail or Virginia partridge exists in large numbers in all quarters of the United States east of the 100th meridian, possibly west of it, it matters not in the premises. Taking the state of Ohio as a representative region for the Eastern and Middle States it will be acknowledged that quail on that parallel do not immigrate to the southward in the autumn and return north again in

the Spring. There a covey of these birds can be found every day for an entire season within one hundred rods of the same spot, and even pursuit with dog and gun will not drive them away. But it is quite different in the region we have named. Here the quail do pass to the southward every fall, beginning usually about October first and continuing until mid-November unless the season is severe. The movement is general and is continued persistently. Each covey maintains its organization and its direct, independent march toward the south, not diverging from a right line even to avoid towns or considerable cities. Wide rivers do not deter them—they often fall into the Missouri, not being able to sustain their flight across.. When frightened they scatter but still fly on to the south, quickly calling together again to pursue their certain road. How far they travel cannot be definitely known, as they cannot, of course, be followed, or identified, but that they become poor and lean by their long travels is well known. We can feel certain that they do not generally pass below the northern line of the Indian Territory, as they are found gathered in the southern counties of Kansas in unusual nnmbers during mid-Winter. They pass north with the same fearless directness in March and April, but not always in flocks, having then, in the great part, paired.

The pinnated grouse or prairie chicken migrates to the south in the early autumn and returns northward in the spring, This is not strictly peculiar to this region, but it is more general and the flight is to a lower latitude than in the region east of the Mississippi River.

Piercing cold, driven by furious winds over an unsheltered country, is suggested as the chief cause of these migrations. The same causes affect the smaller birds of all kinds. More of them go south for the winter and they go farther than is the habit of the same species in the Ohio region.

We pass to a peculiarity of another character. Along the Atlantic coast of the United States are many birds of a semi-aquatic character. They frequent the salt marshes, bars, inlets, creeks and tidal margins. They pass backward and forward every season. They are known among sportsmen and writers as "Bay Birds" and this term includes a half dozen varieties of plover, turn-stones, sandpipers, godwits, curlew, etc. Very few of these birds are ever seen between the head of tide-waters of the Atlantic and the western part of the State of Missouri; but as the timber country thins out into broad prairies and the prairies in turn rise into the higher plains, we begin to find in the high, dry altitudes these same birds which we had left in the moist region of the sea levels. What should take this host of waders to the sand-hills and alkali plains of Western Kansas and Nebraska? Here are the great sickle billed-curlew, the golden plover, the smaller and greater willow legs, the common gray plover and the large brown godwit, with almost every species of the other bay birds with which one could become familiar at Montauk Point or Barnegat Bay. The conditions of climate vary widely, as must also be the case with their food, opportunities for resting, and the practice of their peculiar habits of wading and mud-dabbling.

We can only query whether they may be waiting for the return of that ocean which in early geological times we are told covered the great plains.

We pass to another branch of our topic. Mr. Stanley in coming down the Congo met with flocks of pelicans, cormorants, gray plumed herons and white cranes. These strange birds, of uncouth form and weird plumage, seem well fitted to the equatorial wilderness in the valley of that great river. Those birds are indigenous to the retired swamps of Florida and the gulf coast, but they are unknown in the middle region of the United States. On the wildest parts of the Ohio, Tennessee and Cumberland rivers they are so rare, if ever seen, that mention is never made of them. But here on the Missouri, on the Platte and the Kansas rivers, and on all the small lakes of the valleys, all of these species are regularly seen. If one will float quietly down the Missouri in a small boat from St. Joseph to Kansas City in the month of November, he will find, on the bars, not only the great white crane, collossal in height and in the extreme spread of its wings, but the cormorant with its red face, dark plumage and dull, heavy motion; the pelican in groups fishing in the shoal waters and also in the bayous, the plumed heron with long crest and beautiful grey-blue plumage, erect, still and vigilant. He will meet at the same time a half dozen varieties of gulls, ranging from the light grey ocean swallow, smaller than a pigeon, to the enormous white gull of mid-ocean. It is a rare and interesting sight for the keen, business loving people of our latitude, upon this stretch of our great, unpicturesque river, to find these denizens of foreign lands sporting and feeding among the wild fowl, of which the usual varieties are so plentiful upon our waters.

Here we wish to place on record a narrative of a most singular occurrence witnessed by the writer and a friend while hunting ducks at Bean's Lake in Platte County, Missouri. It will be found a most vivid illustration of the topic under consideration, while at the same time describing the wonderful intelligence of a bird whose habits of solitary life have kept it beyond the ordinary observation of men.

While sitting behind a "blind," over our decoys, waiting for game, on the 3d day of April, 1875, we saw at the distance of a mile toward the west end of the lake a large number of huge white birds, and, watching them curiously, finally discovered that they were coming toward us on the water—a host. In an hour the mass was abreast of us, and proved to be made up of pelicans, a band we estimated to be sixty feet in width and three hundred feet long closely packed together, each one touching his neighbors on all sides. It appeared as though a foot ball could not have fallen to the water at any point on the band. They moved as a raft might move with a slow current—no motive power visible, each one maintaining his place without flutter or struggle. Moreover, they were unlike swan or geese in that their heads were not raised, being drawn backward and laid upon the back between the wings, while the long mandibles lay forward, flat upon the neck. Not a sound or a motion from an individual, only the still, solemn glide of the entire raft. And yet there were many thousands of them. Allowing a foot in width and a foot and half in length for each bird, there were twelve thousand

pelicans before us. They passed on to the lower end of the lake, then almost immediately rose and flew back over us and settled again in the shoal water. While flying, the pelican shows the broad black band on the extreme feathers of the wings, and would be a very beautiful bird, but it does not stretch forth the neck, even while flying, thus appearing like a swan with his head cut off—*very awkward.* During the day this vast multitude was joined by scores of large flocks, which came down from the sky, circling down in narrow spirals from a height from which they could not be seen. Whence did they come? What was the object of the meeting? Who was the messenger that had called this horde together? They must have gathered from all the corners of the earth, for by extensive inquiry made since that day among those most likely to know, no witness has been found who ever saw more than fifty together in one place in this region. All day long they moved slowly about the upper end of the lake and only occasionally did small groups fly about or splash in the water. A great and solemn convention was evidently being held. Toward evening, however, we saw more commotion among them and, desiring to witness more closely this wonderful gathering, we went up the lake toward them. After quietly approaching within a half mile of the nearest, we saw that a general motion was being made in our direction, whereupon we concealed ourselves close to the edge of the water and from thence during the next hour witnessed the most amazing pageant of our lives.

The number had clearly doubled since morning, and the entire troop were arranged in line and engaged in a movement the object of which we could not at first make out. The line was some three hundred yards in extent, and at least thirty birds in depth—all "dressed" to the left (continuing the military figure), and at that wing resting upon the bank from which the line slightly diverged, at the extreme right being some thirty yards out; the general movement being toward the shore. As the birds on the left reached the land, they immediately rose in the air and passed back of the line and formed again on the extreme right. In this way probably five hundred birds were flying at a time, and by this method of deploying from the left to the right wing, the grand army was being rapidly moved toward us. When quite near and before us we easily saw that the object of this advance in order of battle was not mere dress parade—each bird was rapidly dashing his head under water, bringing up fish. This long line then was a seine fastened to the bank at the left and being gradually drawn toward the shore, driving the finny prey into the shallow water where it was incontinently swallowed by the living meshes of this enormous net. Nothing could be of more thrilling interest than to witness the intelligence with which this enormous flock carried out every detail to success. Several times we noticed a detachment, as if detailed for special duty, swing around over some deeper pool, flying so as to drag their feet and flap the extremities of their wings upon the water, closing in finally at the open end of the net on the right. Had a skiff load of boys been sent out with poles to splash the water and drive in the fish, the maneuvre could not have been plainer in its object than was the one before us. Why should one flying group "drive" in this way, while other scores passed regularly on to their places?

Where was the commander-in-chief? There was no struggle for precedence, no fighting, no pressing out of line; here was a voiceless, disciplined multitude, intelligently carrying out an elaborate plan.

When the line had advanced and lay within thirty feet of us, we rose quickly and fired our guns over them; and when this myriad rose, utterly filling the air, the broad wings crashed against one another with the roar of a hundred trains. Thus closed this most wonderful spectacle.

A specimen we obtained measured nine feet and a half from tip to tip of the wings. The mandibles were fifteen inches long, and the pouch held two quarts of wheat.

On this same day we observed on the bank of the lake a small flock of of Cedar birds. These are rare visitors, so rare that our best observers seldom see their bright, brown plumage, crested heads

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CORRESPONDENCE.

SCIENCE LETTER.

PARIS, November 26.

The most popular of the scientific sections of the Exhibition, is undoubtedly that devoted to Anthropology. It is happily symbolized by a statue near the door, holding a skull in one hand, and a compass in the other. M. Quatrefages defines Anthropology as the "Science of Men," as zoölogy is the science of animals, and botany the science of plants. But it has subdivisions. Anthropology is "zoölogic," when we wish to describe not only man's place in nature, but the characteristics which establish his quality of man. It is "ethnographic," when we compare the races of man—a most difficult branch. It is "pre-historic," when we study antique man; "linguistic," when we research the ties of language and the migrations of people—the surest of all tests; and it is "demographic," when it investigates the condition under which people develop and extend; how they degenerate and die out. The last classification can be applied to Europe with a mathematical precision. The "zoölogic" standpoint is the most thorny; it has to encounter all the nonsense propagated about the descent of man from monkeys, and is placed in opposition to theology. Science has nothing to do with either theology or politics; it seeks out facts, and reasons coldly over them; free to those who please to build up or demolish theories accordingly. It is, however, clear that the sole means to classify a being in natural history, is to ascertain the distinctive characters which separate it from other beings. Why should man be exempted from this simple and general rule? Hence, why the skeletons of monkeys are necessary for comparison, those of the ourang-outang especially, because it alone of all the monkey tribes is a biped. A vertical position modifies the whole animal system. The form of the vertical column, the

position of the muscles, of the viscera, and notably of the heart, are widely different in a quadruped and a biped. But the skull of the great monkey, owing to the enormous muscles of mastication, is the very opposite in shape to man's—it tapers at the summit so as to form a crest. Skulls are divided into two classes, the round and the elongated, with many intermediary forms. The negro never comes under the first, still less the Laplander under the second class. The brain is too soft to be dissected, and very difficult to be preserved; so it is weighed, and the capacity of its shell, or skull, measured. Anthropology has nothing in common with phrenology. It is curious, and morally and legislatively an important fact, that in the collection of murderers' skulls, from the Caen museum, traces of an old malady of the brain or its envelopes are uniformly discernible.

The form and color of the hair have their importance; the eudimous crisped hair of the Papuans contrasts singularly with the straight character of that of the Chinese—largely employed in Paris. In the latter case the hair is cylindrical, in the former it has a ribbon nature. Savages dye their hair as extensively as civilized people. There are specimens of domestic life, and dressed models of various peoples, exhibited. It is curious that while the peasants of Finland—every one of whom knows how to read and write—and of Sweden, are essentially different as to type, they are identical in point of dress, cottages and furniture, while the Laplander resembles neither. Finland borrowed her civilization from Sweden, and Swedish is the language spoken in her cultivated circles. But here are French girls from Savoy and Auvergne, who represent on their robes the amount of their *dot* or fortune; for every thousand of francs they possess, they place a row of braid at the bottom of their jupe. Now, certain Indian tribes do exactly the same. The Indian collection of the Prince of Wales, so valuable materially and artistically, is also so, anthropologically; the specimens of the swords are remarkable for the smallness of the handles, for the natives have hands at once little and elegant. The same diminutiveness characterizes the arms of the age of bronze, thus confirming the opinion that the people who brought that metal into Europe were of Indian origin. The brooches and clasps actually in use in India, have been found in Ireland, in the sepulchres of the age of bronze. Japan displays photos of the Hinos, a population with European traits, who formerly inhabited Japan, and now are cooped up in a corner, in process of dying out. Among the specimens of arms from Australia and Polynesia, the latter have no bows, and so differ from all other nations, while the Papuans possess these weapons. But the Papuan bow is very imperfect, and in no respect resembles that of the Greeks or the archers of the middle ages, when the bending of the bow was a difficult operation. It was in being alone able to bend his, that Ulysses made himself known to the Ithacans. The bow of the English archers, such as it is represented on old tapestry, was that of the ancient Mexicans, and such is still the weapon of negro bands. The women of the Kabyle tribes make the famous Algerian pottery; it is ornamented with Arabian designs, but the fabrication displays the impress of the women's fingers, thus connecting the pottery with that of the epoch of the dolmens. The castanets that

the Moors imported into Spain are of negro origin; but the negroes use iron castanets, and it is known that it is to them that we owe the transmission of industries in iron. The ancient inhabitants of Arizona and New Mexico, scooped their dwellings in almost inaccessible cliffs, with a kind of goat-path leading thereto, and for greater security the entrance even to the house was effected by meansof a ladderr Their descendants, judging from the model of a village shown, no longer live in cavern houses, but in villages enclosed by walls, where the houses are so close together as to appear to be piled one above the other, and all have the ladder mode of entrance still.

Two theories of the origin of carbonic acid have been propounded, and which, if not conclusive, are ingenious. The air is composed of two gases, oxygen and nitrogen, in proportion of nearly one and five respectively; to these must be added small quantities of watery vapor and carbonic acid. Vegetation absorbs this acid from the air, for its chief food, while at the same time purifying the atmosphere. When charcoal is prepared, we merely extract from vegetation the carbon it had appropriated from the air. Though only present in small quantities in the air, the importance of carbonic acid is such, that without it vegetable, and consequently, animal life, could not exist. But it also plays a prominent part in the constitution of the strata of the earth, combined with lime and magnesia, for example. It is thus we have marble, chalk, etc. In the granitic rocks, that form, as it were, the skeleton of the globe, lime and magnesia are found, but not carbonic acid. How, then, were the calcarean beds, containing fossil remains, supplied with their carbonic acid? Either the air at one time contained an excess of it, or it was derived from an exhaustless source. The first hypothesis is since a long time abandoned. It is calculated that a layer of lime, nine yards thick, and covering the globe, would absorb a weight of carbonic acid equal to our actual atmosphere, to be transformed into a carbonate. Supposing that all the carbonic acid fixed in rocks, existed then at one time in a free state, the total quantity would have been such, that under its own weight it would be relinquished, and life thus rendered impossible. Now it is precisely since the appearance of life on the earth, that the carbonate rocks have been formed. Enormous quantities of carbonic acid must have arrived to replace those absorbed. Consumption on one side, supposes restitution on the other. From whence comes this restitution. One theory maintains, that oxygen, nitrogen, and carbonic acid, exist in space, become condensed in the neighborhood of planets, following the density and temperature of the latter, forming atmospheres, and thus supplying surfaces with all the carbonic acid they need. However, the moon has no atmosphere, and Venus and Mercury are provided with thick, gaseous envelopes, not at all in proportion to their volume. Asteroids, like the moon, have no atmosphere, and consequently no relation with condensed universal cosmic matter. The other theory, confirmed by many eminent geologists, is that carbonic acid emanates since all time from the interior of the earth, welling up to the surface. The masses of iron found at Ovifax, on the coast of Greenland, re-

semble in composition, meteoric iron, as well as that of iron from the basaltic rocks, both containing carbon; carburet of iron has been found in the oldest granitic rocks. But how does the oxidation, to form the carbonic acid, take place, since oxygen is very rare in the interior of the globe? M. Cloiz has shown that by acting on cast iron with hydrochloric acid and water, or simply with steam on a mixture of iron, magnesia and carbon, he has obtained oils, bitumen and petroleum, and which explains the origin of this mineral oil; carburetted hydrogen is thus formed, and as it ascends toward the surface of the soil, it encounters oxygen, carbonic acid and water being the result. All this involves the supposition that the center of the globe consists of a kind of kernel of carburet of iron, which can be dissolved by the action of water. Volcanoes vomit volumes of carbonic acid, mineral waters are rich in it, and certain fissures in the soil exhaleit. The presumption then is that the source of carbonic acid is from below, not from above.

France, in railway rolling stock, displays at the exhibition, not so much anything original, as a readiness to adopt what is practically beneficial. Her companies establish a difference between passengers and merchandise; we are transported more rapidly, and in a certain degree, more comfortably and safely. Fearing that the English traffic would be attracted by Belgium and Germany, more powerful engines have been employed, and hence greater rapidity secured. But "wild cat" and "lightning trains" are still unknown. Again, only first-class carriages make up an express; the "sleeping car" is still a luxury, and not far removed from a novelty; no trains are lighted up with gas, as in Belgium. But the roads are good; steel rails, and of greater length—12 instead of 6 yards—are employed, and only oak sleepers used. Tenders being larger, contain more water, and thus necessitate less stoppages. The steep lines and short curves in the districts of the Cercunes work admirably, and in the tunnels, full of vitiated air, the engine driver and stoker are provided with respirators, and inhale, for the time being, pure air stored in a cylinder. On the line from Bayonne to Bianitz, M. Mallet has employed the compound system of locomotive and Cardiff coal, with advantage and economy. All classes of carriages are now heated with hot water foot pans; the second-class compartments are wider; the wheels are lubricated with oil, not grease, and the smoky oil lamp has nearly been replaced with rectified petroleum. Rapid traveling and increased traffic augment the chances of collision, hence the question of brakes. Formerly a train could not be stopped in less than 900 or 1,500 yards; a second on a railway, as in navigation, has a life or death importance; in a second an express runs 22 yards; in 22 yards, in a second less, a catastrophe could be avoided. The brakes in favor are, the Westinghouse and the Smith; the former works by compressed air, and by the driver simply turning a cock, he can pull up a fast train in a distance of 200 yards—the length of an ordinary platform. Hence, when the traveler imagines his train is running through a station, it suddenly comes to a stand still, with more or less of a shock, as the driver, if in good humor, neatly applies the

blocks. The brake is also automatic, each carriage being provided with a reservoir of air, so that if a separation in the connecting pipe ensues, the blocks, owing to the rupture, will instantly and independently grip the wheels. In ordinary working the brake stops the first carriage next the engine, then the second; hence, telescopic shocks are experienced. The connecting air-pipe makes the formation of the train an inconvenience, and the valves, very delicate, require a special repairing. The Smith brake acts by rarefied air; a kind of India rubber bellows is under each carriage, with a bar commanding the blocks; a feed pipe communicates with the engine; a jet of steam in the pipe chases the air, and creates the necessary vacuum; the last carriage is stopped first; hence, there are no telescoping shocks as in the rival plan, and the trains further are easier to make up. It suffers from the drawback of not being automatic. It would be well if companies adopted a uniform brake as in Belgium. M. Achard's electric brake is destined for the future. The Lartigne signal is working well; as soon as a disc falls it liberates a current of electricity which lodges in a block of metal at a long distance from the signal; the approaching locomotive is provided with a metallic brush, which, sweeping the block, communicates the electric current by a wire to the whistle, and the latter automatically "blows"; the current even can be arranged to act on the cock of the brake tube, and thus pull up the train, even were the driver to be in a trance. The "definite brake" has yet to be found, but the "Smith" is generally viewed as the most practical up to the present.

Aided by the Council General of Tours, M. Mouchat has been able to repeat on the Trocadero, his experiments of boiling, wasting, and distilling, by means of the sun's rays, collected by a reflector 22 yards square, and concentrated on a boiler containing 70 quarts of water, which on the 2d of September, were converted into steam, in half an hour. The steam next pumped 2,000 gallons of water two feet high in an hour, and then worked the Carrè machine, and turned out blocks of ice; smaller reflectors cooked a pound of beefsteak in twenty minutes, made a pot of soup, and distilled and rectified brandy. In Africa and kindred countries, where the sun is rarely obscured and fuel may be wanting, the invention might be utilized, but its drawback consists in not being stationary; a delicate clockwork movement is necessary to make the reflector constantly face the sun, follow the orb, in a word. F. C.

A NEW ELECTRIC LAMP.—M. G. Reynier describes in the Camptes Rendus, 1878, lxxxvi, p. 1193–94, a light which obviates the use of regulators. It consists simply of a thin rod of carbon which is connected with one pole of the electric generator and is pressed against a wheel which is connected with the other pole. The carbon glows at the point of contact, and, as it bures away, moves the wheel to another point of contact. The inventor claims to have produced a light by means of four Bunsen elements and to have produced several lights in the same circuit.—*Am. Journal of Science.*

ASTRONOMY.

RECENT THEORIES OF THE TIDES.*

J. M. ARNOLD, BOSTON.

"The tides," says Dr. Herschel, "are a subject on which many persons find a strange difficulty of conception. That the moon by her attraction, should heap up the waters of the ocean under her, seems to many persons very natural. That the same cause should at the same time, heap them up on the opposite side of the earth, seems to many palpably absurd."

The explanation of the cause of the tides, usually given in text books and popular treatises on the subject is, that as the attractive force of the moon decreases as the square of the distance increases, the waters of the ocean under the moon are attracted more strongly than the center of the earth is attracted, and consequently are slightly drawn away from the earth, by a force equal to the difference between the attraction of the moon at these points. On the other hand, the center of the earth being more attracted toward the moon than the waters on the opposite side of the earth, the solid nucleus of the earth is drawn away from the *waters* on the opposite side, by a force equal to the difference of the moon's attraction on these points, thus leaving the waters on that portion behind. There would therefore be two tidal waves existing on opposite portions of the globe, which, by its daily revolution, would cause at any particular point on its surface, two high and two low tides in each lunar day. This theory of the tides is given by Lockyer in his "Text Book on Astronomy," in Appleton's Cyclopædia, and in Johnson's New Cyclopædia, in the appendix of which is an exhaustive article by Gen. Barnard, giving the mathematical formula for finding the tide-generating force on this assumption.

About thirty years ago a number of text-books on astronomy were published, which, while they gave for the principal cause of the tides the one heretofore given, claimed a secondary cause for the tidal wave on the side of the earth opposite the moon, to be an increased centrifugal force at this point, generated by a revolution of the earth around the common center of gravity of the earth and moon, but this influence they agreed was a very slight one.

Thus the matter stood until the *Popular Science Monthly* for July, 1877, published an article on the tides, in which the writer maintained that the explanations hitherto given in our text-books, were entirely wrong, and that the real cause of the tidal wave opposite the moon was centrifugal force alone. This writer received much adverse criticism which was published in subsequent numbers of the *Monthly* in the form of correspondence, until the editor refused to give any more space to the controversy.

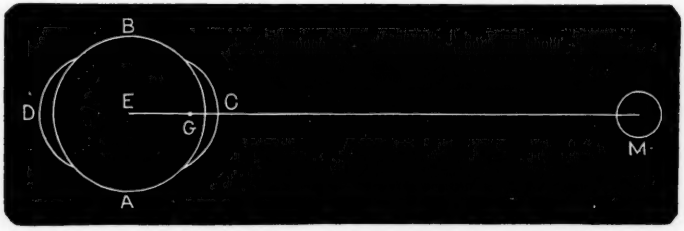
[Read before the B. A. S. S., October 10, 1878.*]

In a course of popular lectures on astronomy, delivered in this city last winter, the lecturer, after giving the usual gravitation theory of the tides, told his hearers that he thought a better explanation of the cause of the tide on the opposite side of the earth, would be that it was the effect of increased centrifugal force on that side, owing to the rotation of the earth around the common center of gravity of the earth and moon. To illustrate this idea he called on his audience to imagine a huge spike driven through the earth, so as to pass about three thousand miles to one side of its center, and the earth revolving like an eccentric on this spike once in each lunar month.

As this theory of increased centrifugal force on the portion of the earth opposite the moon causing a high tide at that place, has been adopted by one of our ablest astronomers, Prof. Newcomb, of Washington, in his recent work on "Popular Astronomy," I propose in this paper to inquire,—1. What is the direction and amount of the centrifugal force generated by the motion of the earth around the common center of gravity of that body and the moon? 2. What effect has this force upon the tides?

In the discussion of these questions I shall take a view of the matter that will be somewhat opposed to that of Prof. Newcomb, and will, therefore, give an extract from his work, covering what he has to say on this subject.

He says, "Now, strictly speaking, the earth does not revolve around the moon any more than the moon around the earth; but, by the principle of action and reaction, both move around their common center of gravity. The earth being eighty times as heavy as the moon, this center is situated within the former, about three-fourths the way from its center to its surface, at the point G in the figure.



The manner in which the moon produces the tides is much the same as that in which precession is produced. Near the center of the earth, E, the centrifugal force of the earth's monthly rotation around G, and the attraction of the moon, counterbalance each other, so that a point there has no disposition to move under the influence of the combined forces. As we pass from E to D, the part of the earth's surface opposite the moon, the centrifugal force around G keeps increasing, owing to our greater distance from the center, while the attraction of the moon diminishes. Hence, at D the centrifugal force predominates, and tends to throw the waters of the ocean out, as shown in the figure. Again, as we pass from the center E to C, the centrifugal force constantly diminishes till we reach the center of revolution, G, when it vanishes, and, beyond G, begins to act in

the opposite direction. Hence, at C the attraction of the moon and the small centrifugal force around G both combine to throw the waters of the ocean out in the direction of the moon. Thus, there is a force causing the waters to rise at D and C, and therefore to fall at A and B; and there are, therefore, two tides to each apparent diurnal revolution of the moon."

It seems to me that Prof. Newcomb gives us here an entirely erroneous conception of the nature of the motion of the earth around the point G.

That this motion is such that the center of the earth will describe a small orbit, of about three thousand miles radius, around the point G, is true, but this motion is one of translation simply, and not a motion of rotation, as one would infer from Prof. Newcomb's explanation.

The earth has a daily rotation about an axis inclined considerably to the plane of this orbit, but this rotation is entirely independent of its motion around the common center of gravity of the earth and moon. If the axis of this rotation was always inclined toward the moon so as to follow it in its monthly course, then we might say that the earth had another motion of rotation about an axis perpendicular to the plane of the moon's orbit, making one rotation in each lunar month. But as the direction of the axis of daily rotation remains fixed in space, and does not follow the course of the moon in its orbit, we can in no sense, call the motion of the earth in the small orbit around G, a motion of rotation.

As an illustration of the nature of this motion, suppose a person to bend the trunk of a small tree to one side and then move it around in a small circle. The roots of the tree being fixed in the ground, rotation cannot take place, but the center of the top of the tree, moving in a small orbit, will be somewhat analagous to the monthly motion of the earth around the point situated in its interior, about one thousand miles from its surface, and called the common center of gravity of the earth and moon.

Having seen what the nature of this motion is, we next inquire what will be the centrifugal force generated by this motion. At the center of the earth the centrifugal force will balance the attraction of the moon at that point. The centrifugal force developed by any particle, situated at any point on the surface or in the interior of the earth, will be the same in amount and direction as that of a particle at the center. For when we consider that this is a motion of translation without rotation, it is plain that every particle moves with the same velocity on a curve of the same radius. Therefore instead of the centrifugal force being greater at the side of the earth farthest from the moon, and decreasing as we go to the point G, where it becomes zero, according to Prof. Newcomb, I claim that the centrifugal force is the same at all these points, the point G included; for at the same time that the center of the earth is describing an orbit about G, that portion of the earth which at the moment coincides with G is also describing an orbit of the same radius about a center situated three thousand miles in a direction toward the moon on a line joining the centers of the two bodies. At the point C, directly under the moon, it will act in a direction away from the moon, toward the center of the earth, and not in the direction stated by Prof. Newcomb.

We will now consider the effect of these disturbing forces on the waters of the ocean. Each particle will be acted on by two opposing forces beside that of the earth's gravitation, which we call its weight, the moon's attraction and the centrifugal force. This last force being constant in amount, and the attraction of the moon varying with the distance, the particle will tend to move in the direction of the greater force. If placed at the center of the earth, these forces being equal at this point, no tendency to move either toward or from the moon will take place. But if placed on the earth's surface nearest the moon, a slight tendency to move away from the earth and toward the moon must take place, owing to the excess of the moon's attraction over the centrifugal force. On the other hand, if placed at the point farthest from the moon, a slight tendency to move away from the earth, and also away from the moon, will take place, owing to the excess of the centrifugal force over the moon's diminished attraction. The amount of this disturbing force is small, being only about one-thirtieth of the intensity of the moon's attraction upon the particle. But according to Prof. Newcomb's theory, a particle placed at the point nearest the moon feels a lifting force, equal to the whole of the moon's attraction upon it, and the centrifugal in addition, which would give a tide-generating force about forty times larger than it really is. In fact this theory would show that a belt of water would be raised, completely surrounding the earth in the plane of the moon's orbit, making an ellipsoid of three unequal axes.

Without entering into any discussion as to the nature of centrifugal force, which is by some denied to be a force in the strict meaning of the term, I think it will be conceded that the cause of the tide opposite the moon is due to this force. Prof. Newcomb has done well therefore, in a popular work on astronomy, to give this explanation of the tides, instead of that usually given in the text-books, but, by an apparent misconception of the nature of the earth's motion around the common center of gravity of the earth and moon, I think he gives an erroneous view of the magnitude and direction of the centrifugal force. A like criticism would also apply to his explanation of the cause of the precession of the equinoxes.

The question arises, shall we abandon the common explanation of the tides given in the text-books, as the writer in the *Popular Science Monthly* would have us do? Not necessarily. The old explanation of the text-books, views the subject from a somewhat different standpoint, and by a chain of reasoning, different though valid, precisely the same result is reached.—*Science Observer—October.*

Prof. W. T. Sampson. U. S. Navy, after careful observations of his own, concludes that the light of the sun's corona is not all reflected light, and that all the observations of others, taken together, show that the continuous spectrum of the corona is not the spectrum of the sun. He also concludes that the corona is to a considerable extent self-luminous.

STAR-LIGHT IN WINTER.

The Heavens declare the glory of God and the firmament showeth his handiwork.—[Psalms, xix:1.

Through summer's night, by gentle breezes fanned,
Each sleeping flower gives fragrance to the air;
And while we wander o'er the silent land
There comes a sweet relief from carnal care.

But, to observe the glories of the sky,
Far better is a clear cold winter's night,
When no deceptive mist is spread on high,
And thin frost air unveils each starry light.

Now, while our orb keeps up her endless roll,
The mighty constellations seem to march
In varied circles 'round the Northern Pole,
And constant change goes on in Heaven's arch.

Seen first in order from yon central star
The seven gems of Ursa Major's train
With mellow luster glimmer through the air,
And shed their rays along the Arctic plain.

Here calm Capella sweeps above the scene,
There Aldebaran gives his fiery light;
And from the eastern hills with glow serene
The silvery Twins are sailing up the height.

Now, slowly swinging down the cloudless North,
Soft Lyra's star illumes the purple sky;
And o'er the misty South is looking forth
Orion's band—the fairest group on high!

Blood-colored Mars shines fiercely o'er the west,
And farther down pale Saturn sheds his ray;
While just above yon mountain's cloud-like crest
The Queen of Love reflects her monarch's day.

Up from yon shadow-wave a star ascends
That with a regal beauty meets the sight,
And to the realm its flaming glory lends—
'Tis radiant Sirius—the King of Night!

Thus from their stations in the ether dome,
Do shine the leaders of the twinkling host:
And when toward the lesser lights I roam,
Amid their countless numbers I am lost.

Yet, though the mortal mind can never rise
To even comprehend the starry way,
Jehovah's might a law of Love supplies
That all the spheres are willing to obey.

By day and night this omnipresent Love
Is ever manifest to eye and ear,
For every scene of Earth or Sky above,
Displays the magic word in letters clear. X.

BIOGRAPHY.

PROFESSOR SIMON NEWCOMB,

OF THE UNITED STATES NAVAL OBSERVATORY.

This gentleman is yet in the prime of manhood, having been born in the province of Nova Scotia on the 12th of March, 1835. He is of New England stock, his parents, on both sides, being of families which had emigrated to the province. His father was a teacher of a village school, and possessed but the moderate capabilities of a teacher of forty years ago. He, of course, conducted his son's early education, but the youth having a decided taste for arithmetic, had mastered the subject, as far as his father was able to carry him, before reaching his twelfth year. He also possessed a marked disposition for reading, and the few books which came in his way were eagerly conned. Among them were a Latin and Greek grammar and readers. He also studied the rudiments of French with a teacher, but a better opportunity of acquiring a knowledge of that language was found among neighbors who were descendants of early French settlers in the province. Later he studied algebra diligently—a text-book having been loaned to him by a clergyman. Ere he was eighteen he had thus fitted himself to teach, and obtaining a school in Maryland, set out in life for himself.

About the year 1856 the late Professor Henry, of the Smithsonian Institution, had his attention drawn to young Newcomb through a communication on a scientific topic which the young man had ventured to send to him. This led to other correspondence which awakened such an interest on the part of the eminent scientist that he sought and obtained for Mr. Newcomb a position as computer in the office of the *American Nautical Almanac*. Here was a most welcome field for study and effort on the part of the young mathematician. In it he found the material he most earnestly desired, and all the incentives for diligent study. The office of the *Almanac* being then at Cambridge, Massachusetts, he found it convenient to attend as a student the Lawrence Scientific School, where he heard the lectures of Professor Pierce. He studied also the works of La Place and La Grange, and then entered the field of original investigation. At twenty-six he was appointed Professor of Mathematics in the United States Navy, and assigned to duty in the Naval Observatory at Washington.

Professor Newcomb acquired distinction in his branch of scientific inquiry much earlier than the average of men; indeed, he laid the foundation of his fame while a tutor at Cambridge, having then written a paper on "The Secular Variations and Mutual Relations of the Orbits of the Asteroids," in which he exhibited unusual thoroughness and care in his examination of what had already been written on the subject by eminent astronomers, and high ability in his demonstration that the orbits of those small planets could not have intersected unless they had been deranged by some undiscovered cause. To be sure, little attention had been given to the study of asteroidal movements by astronomers hitherto, but the thoroughness, accuracy, and originality of his treatment drew marked attention. A work of considerable importance, produced during his connection with the Naval Observatory, is an "Investigation of the Orbits of the Two Outer Planets, Uuranus and Neptune," which is accompanied with elaborate tables. Toward the preparation of these tables Professor Henry contributed valuable assistance by supplying him with necessary funds from the Smithsonian treasury.

In 1867 Professor Newcomb published his studies with reference to the distance of the sun, a work deemed of high importance by both foreign and American astronomers, who have generally adopted the value of the solar parallax, 8".848, which is one of his conclusions as set forth in the work. In 1870 he visited Europe for the purpose of observing the total eclipse of that year, the path of which lay in the Mediterranean. He was appointed by our government one of the commission to prepare plans and apparatus for the observation of the late transit of Venus, and as secretary of that commission performed the considerable share of duty which fell to him with his customary thoroughness. In late years Professor Newcomb's labors have been in the main directed toward the moon and the possible variability of the sidereal day. He has published several papers on this subject. Hansen's tables of the moon, hitherto received as authority, have been found to deviate from observation for several years, and in a very remarkable manner, and that eminent astronomer has assigned as the cause for such deviation an acceleration in the rotation of the earth. The outcome of

Professor Newcomb's study is the practical demonstration of such accelerated rotation.

Professor Newcomb's name is not associated with any remarkable discoveries, but owes its reputation chiefly to his accurate and thorough work in mathematical astronomy. A writer in the *Popular Science Monthly*, while alluding to this, says: "Perhaps the secret lies in the unity of purpose which has characterized all his efforts. His special field has been that of exact astronomy, the predictions of the motions of the heavenly bodies from their mutual gravitation, and the perfection of the tables in their data, from which the *Nautical Almanac* is prepared, in order that the navigator and surveyor may be enabled to find their way by sea or land. When the late Admiral Davis founded the *American Nvutical Almanac*, some twenty-five years ago, the tables and other materials for its construction were extremely imperfect, but Professor Newcomb's studies have all tended to their improvement.

Professor Newcomb's latest publication is a treatise on astronomy for popular reading. This has already obtained a wide circulation on both sides of the Atlantic, and is generally deemed one of the most clearly-written and interesting works of its class in print.

He has been the recipient of many academical and society honors. In February, 1874, the gold medal of the Royal Astronomical Society of Great Britain was awarded him for merit and valuable contributions to the progress of astronomical science. The same year the Columbian University, at Washington, gave him the degree of LL D., which was confirmed in the following year by a similar honorarium from Yale. He is a member of the American Academy of Science, and of the American Academy of Art and Science, besides being associate member of several learned societies in Europe, including the Royal Astronomical Society of Great Britain, the Imperial Academy of Sciences of St. Petersburg, and the Swedish Academy of Science.

In 1876, Professor Newcomb was elected President of the American Association for the Advancement of Science. His term expired this year, and at the annual meeting of the association, which was held in St. Louis in August last, he delivered an address on retiring from the official chair, in which the frankness of the man and the acuteness of the savant are strikingly apparent.*

PROFESSOR D. E. HUGHES.

David Edwin Hughes was born in London in 1831. His parents came from Balla, at the foot of Snowdon, in North Wales, and in 1838, when David was seven years old, his father, taking with him his family, emigrated to the United States, and became a planter in Virginia. The elder Mr. Hughes and his children seem to have inherited the the Welsh musical gift, for they were all accomplished musicians. While a mere child, David could improvise tunes in a remarkable manner, and when he grew up this talent attracted the notice of Herr

[* Published in the September and October numbers of the *Review*, in full.]

Hast, an eminent German pianist in America, who procured for him the professorship of music in the College of Bairdstown, Kentucky. Mr. Hughes entered upon his academical career at Bairdstown in 1850, when he was nineteen years of age. Although very fond of music and endowed by nature with exceptional powers for its cultivation, Professor Hughes had, in addition, an inborn liking and fitness for physical science and mechanical invention. This duality of taste and genius may seem at first sight strange; but experience shows that there are many men of science and inventors who are also votaries of music and art. The source of this apparent anomaly is to be found in the imagination, which is the fountain-head of all kinds of creation.

Professor Hughes now taught music by day for his livelihood, and studied science at night for his recreation, thus reversing the usual order of things. The college authorities, knowing his proficiency in the subject, also offered him the Chair of Natural Philosophy which became vacant, and he united the two seemingly incongruous professorships of music and physics in himself. He had long cherished the idea of inventing a new telegraph, and especially one which should print the message in Roman characters as it is received. So it happened that one evening, while he was in the glow and enthusiasm of musical improvisation, the solution flashed into his ken. His music and his science had met at this nodal point.

All his spare time was thenceforth devoted to the development of his design and the construction of a practical type-printer, and, as the work grew upon him he became more and more engrossed with it, until his nights were almost entirely given to experiment. He begrudged the time which had to be given to teaching his classes; and the fatigue was telling upon his health, so in 1853 he removed to Bowling Green, in Warren Co,, Kentucky, and acquired more freedom by taking pupils.

The main principle of his type-printer was the printing of each letter by a single current; the Morse instrument, the only other rival then in the field in America, required, on the other hand, an average of three currents for each signal. In order to carry out this principle it was necessary that the sending and receiving aparatus should keep in strict time with each other, or be synchronous in action; and to effect this was the prime difficulty which Prof. Hughes had to overcome in his work. In estimating the Hughes Type-Printer as an invention we should never forget the state of science in those days, a quarter of a century ago. He had to find his own governors for the synchronous mechanism, and here his knowledge of acoustics helped him. Centrifugal governors and pendulums would not do, and he tried vibrators, such as piano strings and tuning forks. He at last found what he wanted in two darning needles borrowed from an old lady in the house where he lived. These steel rods, fixed at one end, vibrated with equal periods, and could be utilized in such a way that the printing wheel could be corrected into absolute synchronism by each signal current.

In 1854, Prof. Hughes went to Louisville to superintend the making of his first instrument; but the first patent for it was not taken out in the United States

until 1855. In that form straight vibrators were used as governors, and a separate train of wheel work was employed in correcting; but in latter forms the spiral governor was adopted, and the printing and correcting is now done by the same action. In 1855, the invention may be said to have become a practical success; no sooner was this the case, than Professor Hughes received a telegram from the editors of the American Associated Press, summoning him to New York. The American Telegraph Company, then the leading one, was in possession of the Morse instrument, and levied rates for transmission of news which the editors could no longer stand. They therefore took up the Hughes instrument in opposition to the Morse. A company was formed, and the lines of the smaller fry of companies—among which was the Western Union Company, then doing business on a poor scale out West—were leased. After a time they united, in 1857, with these smaller companies to form one large corporation, the Western Union Telegraph Company of to-day. They bought over the Morse instrument too, and when the monopoly was all in their hands the editors were again left in the lurch.

In 1857, Prof. Hughes, leaving his instrument in the hands of the Western Union Telegraph Company, came to England to effect its introduction here. He endeavored to get the then Electric Telegraph Company to adopt it, but after two years of indecision on their part, he went over to France in 1860, where he met with a more encouraging reception. The French Government Telegraph Administration became at once interested in the new receiver, and a commission of eminent electricians, consisting of Du Moncel, Blavier, Froment, Gaugain, and other practical and theoretical specialists, was appointed to decide on its merits. The first trial of the type-printer took place on the Paris to Lyons circuit, and there is a little anecdote connected with it which is worthy of being told. The instrument was started, and for a while worked as well as could be desired; but suddenly it came to a stop, and, to the utter discomfiture of the inventor, he could neither find out what was wrong, nor get the printer to go again. In the midst of his confusion, it seemed like satire to him to hear the commissioners say, as they smiled all round and bowed themselves gracefully off, "*Tres-bien, Monsieur Hughes—tres-bien. Je vous felicite.*" But the matter was explained next morning, when Prof. Hughes learned that the transmitting clerk at Lyons had been purposely instructed to earth the line at the time in question, to test whether there was no deception in the trial, a proceeding which would have been strange, had not the occurrence of a sham trial some months previous rendered it a prudent course. The result of this trial was that the French Government agreed to give the printer a year of practical work on the French lines, and if found satisfactory, it was to be finally adopted. Daily reports were furnished of its behavior during that time, and at the expiration of the term it was adopted, and Prof. Hughes was constituted by Napoleon III a Chevalier of the Legion of Honor.

The patronage of France paved the type-printer's progress into almost all European countries; and the French agreement with Prof. Hughes respecting it became the model of those of other nations. On settling with France in 1862,

Prof. Hughes went to Italy. Here a commission was likewise appointed, and a period of probation—only six months—was settled, before the instrument was taken over. From Italy Prof. Hughes received the Order of St. Maurice and St. Lazare.

In 1863, the United Kingdom Telegraph Co., England, introduced the type-printer in their system. In 1865, Prof. Hughes proceeded to Russia, and in that country his invention was adopted after six months' trial on the St. Petersburg to Moscow circuit. At St. Petersburg he had the honor of being the guest of the Emperor in the summer palace, Czarskoizelo, the Versailles of Russia, where he was requested to explain his invention, and also to give a lecture on electricity to the Czar and his court. He was here created a Commander of the Order of St. Anne.

In 1865 Prof. Hughes also went to Berlin and introduced his apparatus on the Prussian lines. In 1867, he went on a similar mission to Austria, where he received the order of the Iron Crown; and to Turkey, where the then Sultan bestowed on him the Grand Cross of the Medjidie. In this year, too, he was awarded at the Paris Exhibition of 1867, a grand *hors ligne* gold medal, one out of ten supreme honors designed to mark the very highest achievements. On this occasion, also, another of these special medals was bestowed on Cyrus Field and the Atlantic Telegraph Company. In 1868 he introduced it into Holland; and in 1869 into Bavaria and Wurtemburg, where he obtained the noble Order of St. Michael. In 1870 he also installed it in Switzerland and Belgium.

Coming back to England, the Submarine Telegraph Company adopted the type-printer in 1872, when they had only two instruments at work. They have now (1878) twenty of them in constant use, of which number nine are working direct between London and Paris, one between London and Berlin, one between London and Cologne, one between London and Antwerp, and one between London and Brussels. All the continental news for the *Times* and the *Daily Telegraph*, is received by the Hughes type-printer, and is set in type by a type-setting machine in the very act of arriving. Further, by the International Telegraph Congress it was settled that for all international telegrams only the Hughes instrument and the Morse were to be employed.

In 1875, Professor Hughes introduced the type-printer into Spain, where he was made a Commander of the Royal and Distinguished Order of Carlos III. In every country to which it was taken the merits of the instrument were recognized, and Professor Hughes has none but pleasant souvenirs of his visits abroad.

During all these years, the inventor was not idle. He was constantly improving his invention; and, in addition to that, he had to act as an instructor wherever he went, and give courses of lectures, explaining the principles and practice of his apparatus to the various employés into whose hands it was to be consigned.

What with this work, and his various journeys, Prof. Hughes can have had little time for original work in other directions. But very soon after the type

printer was finally off his hands, his attention was drawn to the telephone. The researches of Sir William Thompson on the variation of electric resistance in a wire subject to stress, led him to enquire whether or not sonorous waves could not be made to vary the resistance of the wire itself of the telephone circuit by stressing it, and the result of his discovery was, as every one knows, the microphone.

The Hughes type-printer was a great mechanical invention, the greatest in telegraphic science, for every organ of it was new and had to be first fashioned out of chaos; an invention which stamped its author's name indelibly into the history of telegraphy and procured for him a special fame, while the microphone is a discovery which places it on the roll of investigators, and at the same time brings it to the knowledge of the people. Two such achievements might well satisfy any scientific ambition. Professor Hughes has had a most successful career, and probably no inventor ever before received so many honors or bore them with greater modesty.—*London Telegraphic Journal.*

ARCHÆOLOGY.

THE ORIGIN OF METALLURGY—THE BRONZE AGE.

FROM THE FRENCH OF EMILE BURNOUF, BY CHRISTOPHER FALLON, A. M.

We are ignorant as to the date of the first appearance of mankind; we have no foundation upon which to rest the chronology of the primitive times. History dates only from yesterday, and yet, among the different nations, presents but fabulous origins. There is no more reality in the first facts related by Titus Livy than in the genealogies of the Grecian heroes. Adam and Eve are an agreeable myth, borrowed perhaps from Persia in the times of captivity; their descendants are the personification of families or of tribes. Grecian chronology goes back about six thousand years prior to our era, but is likewise preceded by a long mythological period. The same may be said of India and China. After all, what are six thousand years? Already have a hundred passed since the French revolution, and does it appear long to any one? Now-a-days events follow each other very fast and progress is rapid, because we possess forces, both physical and moral, of enormous power, by means of which we transform the earth and ourselves. When our ancestors possessed them not, their advances were slow, their achievements small and casual. How can the ocean be traversed, or a large sheet of water crossed without boats, and how can we construct boats if there are no tools of iron or some substance sufficiently hard to work wood, to adapt the pieces and render them imperviable to water? Let us consider the objects we make use of to-day to clothe, shelter, nourish and convey ourselves from place to place, to procure light, heat, books, and so many products of science and art

which adorn our households. It will readily be seen that there is not one which does not suppose the possession and successful employment of the metals. We are now all aware that men have not known them at all times. For a great number of years, they did not possess any, except perhaps a few grains of gold which nature spontaneously gave them, and which they collected here and there on the banks and in the channels of rivers. It was this period which has been called *The Stone Age*, and the tools those unfortunate men left behind them, as evidence of their industries and necessities, are all made of hard stone, of silex, of diorite, of obsidian and of trachyte. This long period of the infancy of man is attested by the strata in which these objects are found, buried beneath mounds of earth which have required centuries for their formation; but the actual geological period had not yet begun when man was already in existence, living among mammoths, bears in caves, and other animals now no longer to be found. In the first place it was necessary that a man, having selected a stone on which to put an edge, should strike it with another in order to scale it. Thus were the first hammer and the first hatchet made; and all other instruments being made in like manner, have given the name of *The Period of Unpolished Stone* to the era during which this rudimentary industry lasted. Little by little it was found that certain stones could by means of continued rubbing wear others which were even harder, and so friction was substituted for percussion in the manufacture of tools. In this way sharp hatchets and scissors were made; round hard stones were bored and handles inserted. Smaller stones of finer quality or brighter color were shaped and pierced and then used as beads. Arms were made in the same way. It was this second period of humanity which has received the name of *The Period of Polished or Neolithic Stone.*

From the beginning, or at least from an early date, men attempted to mould clay into uses of different kinds. This work was done by hand during the entire age of stone. The potter kneaded the clay with his fingers, the impression of which is yet seen on the pottery of those early times. It required constant observation and new means of action to enable the potter first to discover the value of the movement of a wheel, and then to construct one. In fact the turning lathe seems to have been unknown during the whole period of which we speak, but the baking of vases dates far back, for from the time that men could light fires, they observed on their hearths pieces of argil become insoluble by the heat. The black, red or yellow clay which nature furnished them in many places, enabled them to color or paint these roughly made vases; they then polished the surface, yet soft, by means of a stone burnisher, and engraved fantastic figures thereon.

Then came the first metal, which let us say was the common metal, copper. The knowledge of gold certainly preceded that of brass, because gold is found in its natural state in many countries. It, no doubt, was the same with silver the extraction of which is not very difficult; perhaps the same should be said o lead, for from the time globules of metal were found in the ashes of the fire, the man who noticed them must have wanted to know the ore from which it was

extracted, and having found it, must have sought for more in the mountains.

Substances which are producible in hearths, by the mere burning of minerals, must have been first discovered, as lead and glass; artificial glass, usually blue, is found among the objects of personal ornament of the most ancient times. On the other hand, when the extraction of a metal requires a high temperature, or a chemical operation, it may be conceded that such a metal was discovered long after the others and after a number of ineffectual attempts. Copper is found native, but in very small quantities; copper pyrites resembles gold, still the metal is obtained only by complicated operations, as is the case also with tin. Finally after obtaining these two substances, it is necessary, in order to form bronze, to make a fusion—which is attended with difficulties. The bare idea of uniting two metals does not readily present itself to the mind, and when once conceived it is yet essential to learn in what proportions they must be used in order to form a new metal more useful than either.

Bronze appeared in the West when the art of polishing stone had arrived at a state of perfection. We have in our museums, instruments of hard stone made anterior to the appearance of bronze, which our own workmen would not make better nor in any other manner; only they would probably make them faster, for they have means of action and processes which the ancients did not possess. Bronze, at first scarce, became more common in the course of time. Those fabricating it could dispose of it in other countries only in exchange for other objects of the same value, but of a different kind. These objects of exchange caused a demand which could be supplied only by discovery, or by obtaining them elsewhere in sufficiently large quantities to give rise to commerce. The discoveries of which we are about to speak have proved that the quantity of bronze kept increasing, that with this new metal many instruments were manufactured which were previously made of stone, that new ones were invented, and that a time arrived when the substitution of bronze for stone was, so to speak, complete.

The Bronze Age was, for a short time, co-existent with the period of polished stone. There is then a period of transition when these two substances were, in a measure, blended together, and might be comprised under the same title in the age of stone or in that of bronze. It would be a mistake, however, to suppose that metal caused the hard stone to disappear entirely when the superior qualities of the former were discovered, as stone continues to be used for many purposes in many countries where neither bronze nor even iron has yet supplanted it. Thus those small double-edged blades made of obsidian or silex, known as knives, still in use in the Grecian peninsula, in Asia Minor, in Palestine, and no doubt in many other countries, are fastened to pieces of wood and used by the peasants to thrash their wheat or cut their straw. They are of the same shapes as in the bronze age, and are made in the same way; but the predominance of metal over stone, and the abandonment of the latter, in most cases in which it was employed, characterize the long era which followed that of transition and which constitutes the bronze age properly so-called. In the same way that this metal was substituted for stone, it happened that a new metal concurred with bronze, and was

used instead wherever there was a decided advantage in so doing.

Discoveries which were made only twenty years ago, and which since then have been repeated throughout Europe, have enabled us to fix the period of transition from bronze to iron. It differs from that which has been called the first age of iron, and which has, for a long time, been well ascertained. During the latter, iron already takes the first rank and awaits only to be brought to a state of perfection. The transitory period is marked by a slow and progressive substitution of the new for the old metal, and by a reciprocal influence from one to the other.

Iron has not entirely supplanted bronze, as the latter is still much used, nor would aluminum and all the other metals cause iron to be abandoned; but a new substance may answer many purposes better than those that have preceded it, and for this reason be preferred. For a long time hatchets were made of stone, but were set aside when they could be made of bronze; bronze hatchets were the only ones to be found for many centuries, but were also abandoned when iron ones became sufficiently abundant to compete with them in the market. The period of transition from bronze to iron is well characterized in many ways, of which we shall speak hereafter. There is no doubt, at present, of the reality of this change, and it is even becoming apparent how this transition was accomplished, the course the metals have taken to spread from one mart to another, until they have reached the most remote countries of northern Europe; but before exhibiting these grand discoveries of our day, I must give an account of the progress which science has made in the study of ages anterior to any history.

We need not here repeat the list of discoveries relative to the Age of Stone and to the men of those primitive times. The savants of the first empire and of the restoration had denied the existence of what was then called the fossil man. Science and religion united in discrediting even the mere possibility. The discussions which arose when Boucher de Perthes announced the discovery of the remains of such a man in the old alluvia of one of the northern departments have not yet been forgotten. His discovery was followed by the sarcasm of some and the fanaticism of others, until the day when a new generation of savants recognized their authenticity. A short time afterward skeletons of fossil men and remains of their works were found on all sides. The name of Lartet is connected with the exploration of the caverns of Perigord and Languedoc; those of Tomsen and Wilson with the prehistoric antiquities of Denmark; and that of Keller with the lacustrial habitations of Zurich. Since then Boucher de Perthes is regarded as the originator of a new science which forms the connecting link between the geology and archæology of historic times. This science, though of recent date, is always possessed of a great number of observed facts, is methodic and well defined, and its general results are already perceived. Among those who concurred in these first developments there will be found very few erudite men; they are mostly scientific men, geologists, physiologists, engineers, chemists, and perhaps amateurs who delight in this science as a pastime to beguile their leisure hours away. Texts were for a long time the only means of investi-

gation; but the most ancient texts are, in reality, modern, if they are compared with those long periods of which mankind in its infancy passed over. The most ancient Grecian authors, those who under the real or fictitious name of Homer, have bequeathed the Iliad and Odyssey, lived in the Iron age, they related events which occurred many years before, and if real, were accomplished, according to all appearances, in the Bronze age. This does not prevent the author of the Iliad, and especially of the Odyssey, to put iron in the hands of his heroes; thus the poets attributed to the past what was before their own eyes, but which the past never knew. Egypt had not yet begun to furnish these documents which are now being found; it was not known that the first four dynasties at least are anterior to the knowledge of iron in that country. The hymns of the Veda, to serve as scientific documents, should in the first place be classed according to a chronological order and referred, if possible, to certain and determinate epochs. India seems far from being able to throw any light on this subject. As to Genesis, it is known that its origin is a matter of discussion among the learned, and if some, true to their faith, attribute it to Moses, others reject its authenticity and consider it as formed by the union of two opposed traditions into one book. Be it as it may, and admitting the authenticity of Genesis, it is at least certain that its author had little knowledge of the Bronze age, and still less of the Stone age, for it is said that Tubal-Cain, the first metallurgist who is mentioned, "was maker of all sorts of instruments of brass and iron" In fine, the ancient authors cannot have had correct ideas of the primitive times, composed perhaps of decades of years, when writing was not yet in existence. It is possible there were traditions handed down from year to year, still the passage from the Prometheus of Eschylus, in which mention is made of the first men, of their living in caverns, and of the discovery of metals, is too vague to serve as a basis for scientific induction. In fact the ancients were not in a situation so advantageous as ours with regard to the past, which there were no documents to record, as they neither had the means we possess, the inumerable facts which all the countries of the world can furnish, nor the capacity of acting in concert as now throughout Europe by means of communication and typography.

The Greeks made no underground searches. The Romans robbed a great many tombs, not through love of science, but to obtain the valuable objects therein, which have been reburied or have disappeared with them. The Roman church which followed the empire has never favored the positive sciences. The Middle ages were taken up with metallurgy, but their end was that of King Midas; the philosopher's stone was to convert all the metals into gold. The modern spirit, which may properly be called the scientific spirit, after having learned with Bacon and Descartes its real rudiments, has steadily advanced in a series of discoveries. Possessed of the abstract sciences, it has been able to unite conjecture with reality, and found natural philosophy and chemistry.

It then gave birth to that new study, whose subject is human beings; to the physiology of plants, of animals, and finally to the science of man, of which prehistoric archæology forms the first chapter.

Farmers and workmen had for a long time known of the existence of instruments of bronze, and had gathered and sold them before the savants thought of collecting them and organizing a museum. The first collection made was that at Copenhagen. It was Tomsen, who as early as 1836, classified all objects dug from the dolmens, barrows and mounds of Denmark, and founded the Museum of Northern Antiquities, the finest prehistoric collection in Europe. A certain Swede, Sven Nilsson, profiting by Tomsen's work, and by his own knowledge of the barbarians of Oceanica and of other countries not yet civilized, united their industrial works with those of the ancient Danes, and from 1838 to 1843, introduced the study of comparative ethnology. It is not to be supposed that the savages of to-day are descendants of the ancient inhabitants of Europe, but their ways of life are the same, and they make use of the same means to satisfy their wants. There now exist colonies which do not know the use of metals, or which obtain them in small quantities and look upon them as objects of personal ornament; they have nothing to exchange in commerce with the rest of the world.

It was Tomsen and Nilsson who distinguished the stone age from the bronze age; they had found in the northern countries a certain class of tombs in which, besides skeletons and rough pottery, objects of stone are found, but there were no traces of any metal. In others bronzes were found to have served the same purposes as stone, and to have been substituted. In others again appeared articles of iron almost similar in form to those of the bronze of the other graves. It is evident that if the men of the first period had had bronze, they would have used it in preference to stone, while those of the second would have put aside bronze for iron.

Thus the first distinctions of the prehistoric ages were established, and in succeeding years were confirmed. Two years after, M. Worsaae, a Dane, in his book on the ancient times of Denmark, set to work to explain the numerous discoveries of the bronze age made in his country.

Switzerland ranked next. In 1853 there were found in the lake of Zurich, and shortly after in the other lakes of that country, dwellings built on stakes driven in the ground, which have received the name of *pallafittes*. With this discovery of great scientific value, we find the name of Dr. Keller associated. It confirmed those made in Denmark and Switzerland ten years previously. These houses were not situated along-side of each other, but superposed, and presented the three Prehistoric ages Among the ruins of the upper layer was found iron mingled with bronze; in the middle layer just beneath, bronze only, together with objects of stone which the metal had not yet replaced; and lastly, in the lower layers on the bottom of the lake were found articles of stone only, without any metal whatever. At the same time the progressive march of civilization was noticeable by the excellence attained in the art of moulding either pottery or metal. There was no longer doubt as to the succession of ages, nor as to the essential character of each. The lacustrial habitations of Switzerland proved that these three periods of ancient civilization were not confined to the North, but were spread in more central countries.

That same year (1853), was favorable to the prehistoric sciences. While M. Keller was sounding the lakes of Switzerland, there was discovered at Villanova, near Bologne, a necropolis, which has been termed, perhaps not entirely correct, proto-Etruscan. It was examined and described with exceeding care by Count Gozzadini, who made it known the following year, and who has since then made numerous other discoveries. The nature of the objects found in that cemetery showed that it belonged to a time posterior to the last period of bronze, but anterior to the Etruscans, with whom its dead had till then been confounded. It was after the discoveries of Villanova, that *the first Iron age* was assigned a place in science; this age had followed the period of transition from bronze to iron, corresponding to the upper layer of the palafittes, and had perhaps immediately preceded the Etruscan period, which extended down to historical times. Thus the past and present of man seem to be connected by a series of links, so to speak. Archæology is properly a branch of history, and is probably the most substantial part, as it is founded on real facts and not on mere reports often altered and sometimes falsified. Its commencement is connected with prehistoric studies, as the three Prehistoric ages are connected two by two in their order of succession. In ascending from age to age, you arrive at the period of unpolished stone; beyond that there is probably a long term of years ending with man of the quarternary, may be of the tertiary period; that is to say, with the geological epochs prior to the one in which we live. It is at this stage of science that theories begin, as those of Darwin on the origin of the human species and its animal forms which have preceded and followed it.

In 1857, M. Troyon, in publishing the discoveries of Keller, called attention to the problem regarding the origin of bronze; but to solve it, it was necessary that a science as yet of recent date should be further developed by new facts and throughout many countries. After Switzerland, Savoy and Italy made the largest contributions to the study. In lake Varesa, in 1863, Me-srs de Mortillet, Desor and Stopani recognized the period of transition from the age of stone to that of bronze. The pallafittes were noticed only in later years around the fortress of Peschiera.

Since 1862, Messrs. Strobel and Pigorini have found not far from Parma, deposits of loam, known to husbandmen as *terramares*, and therein detected the remains of the old lacustrial habitations; in fact the stakes still remained, and were surrounded by organic matter; from the appearance of the alluvium it was evident that water had remained in the low portions of Emile, and that formerly there had flourished a civilization identical to those of the Swiss lakes.

We cannot here cite the names of all those who, since 1860, have contributed to the advancement of prehistoric studies, but their number has increased in proportion as the increasing interests of research extended, and a method of procedure was adopted.

In 1862, Napoleon III founded the museum of St. Germain, which was established for the purpose of collecting the Gallo-Roman antiquities.

The number of books and memoirs relative to the ancient ages and particu-

larly to the bronze age, is considerable. There are very many public and private libraries throughout Europe, so that it is next to impossible for one man to visit them without devoting much time and money. The need of statistics, as full as possible to give all the learning available to aid in future discoveries, was felt. The demand was supplied by M. E. Chantre's admirable work entitled the *Bronze Age*. In one of the three volumes of which it is composed, there are only tables in which are classed in methodic order, all the objects of the bronze age found in France and Switzerland, with indications of their origin and where they can be seen to-day; there are at present almost 33,000 specimens. The other volumes contain much information of the other parts of Europe from which objects of bronze were gathered. If a work similar to that of M. Chantre was devoted to each of them, it might be easily believed that the conclusions of this savant would be confirmed, as they are founded on a thorough knowledge of all European collections, although his original intention was to have merely given statistics. As no work of this kind had yet been published on the Prehistoric ages, it is to be expected that this one will form an epoch in the science and will be a starting point for new discoveries to begin.—*Van Nostrand's Magazine.*

MUMMY HEADS AND EGYPTIAN ANTIQUITIES FROM THEBES.

"So Joseph died, being a hundred and ten years old; and they embalmed him, and he was put in a coffin in Egypt." This event recorded in the Book of Genesis, happened sixteen hundred and thirty-five years before Christ, or, from the present day, three thousand five hundred and thirteen years.* The contemplation of this lapse of time strikes the mind with a great feeling of awe, and the human intellect staggers at its contemplation; yet it is possible that the head of the mummy which is now before me, steadfastly gazing at me with an expectant, mournful, yet pleasant smile, may be that of a human being, a contemporary of Joseph.

This magnificent specimen has been most kindly presented to me by my friend Mr. Douglas Murray, who, with other relics, brought it from the tombs of ancient Thebes. Thebes was the original metropolis of Egypt, and was in the height of its glory about sixteen hundred years before Christ. The ancient kings of Egypt lived here; the headquarters of the army were here; the sacred temples were here, in which the Egyptian priests performed the high ritual of worship to their gods, typical of the powers of nature, such as Ra (the sun), Amen Ra (the universal power), Neith (Minerva), Thoth (Mercury, the god of knowledge and reputed inventor of writing), Sothis (or the Dog Star), Osiris (the judge of the dead), his wife Isis and their sons, Horus and Anubis; and here, too, it may be possible that Moses was instructed in the wisdom of the Egyptians by Harnetaft, the high

* This date is taken from "Cassell's Bible," where there is a capital engraving of the body of Joseph about to be placed in a mummy case.

priest, and by Tenamen, the incense-bearer, whose mummies are now in the British Museum.

This mummy head was brought from that wonderful Egyptian cemetery where begins, as it were, the City of the Dead, which, with its grand natural approach, has been so ably described by Mr. Douglas Murray himself in this journal of August 22, 1868, No. 135:

"In this magnificent gorge the rocks seemed at times to almost meet above our heads. Along the ancient causeway, and at each side of us rose vast masses of sandstone, piled as if by the hands of giants in confused heaps of fantastic outline. At the end of the valley and facing us, rose to a great height a pyramidal mound of extraordinary configuration, while occasionally a solitary eagle, circling far aloft in the sunny expanse of blue sky, made up a picture grander than Salvator Rosa in his most inspired moments ever transferred to canvas, and which might have been the original for one of Gustave Dore's gigantic and gloomy conceptions. Fit scenery, sufficiently weird, silent and mysterous for the repose of Egypt's greatest dead.

"We presently found ourselves at the entrance to a staircase which evidently led deep into the heart of the mountain. Down these steps, after lighting our pine torches, we carefully descended until we reached a series of chambers, which, once tenanted by a king, has since been designated 'The Harpers' Tomb.' Situated at a short distance from Belzoni's, this wonderful underground palace is certainly next, also in point of interest, to that most celebrated of all great sepulchers. The name is derived from the fact that in a compartment of the tomb are represented two minstrels playing harps, built in exactly the same shape as our model 'Erards,' which are ornamented with gilding, and surmounted each with the head of a sphinx. One of them has as many as thirteen strings; and this sufficiently proves that the ancient people were highly advanced in the cultivation of music, in that respect differing widely from the modern Arabs, whose songs, though very quaint and often pretty, are all of them in the minor key. This minor key, the language of nature, seems a necessary accompaniment to the music of every uneducated and semi-barbarous people. In the compartment which contains the harps and harpers are, scattered in groups, many musical instruments of highly finished workmanship and elegant design, while through the corridors and side chambers are pictures of rich furniture—sofas with crimson seats and gilt supports in the form of lions' feet, spears, shields, daggers, armlets, and the varied accouterments of a warrior.

"Leaving this vault, with the history of its date legibly impressed upon its walls, we descended again by stairs and shafts let into the midst of the sandstone ridge, to several of the royal vaults, all fresh and bright under the red glare from our torches, but we had still to reach the mummy pits, where one may walk through rows of those dark brown Egyptians, swathed in their fine linen cloths, and redolent of the spices wherewith they were embalmed—sight and smell, no doubt, wholesome and salutary to a Capuchin monk, but unpleasantly suggestive to most mortals. The vast charnel house into which we now descended was

crawling with antiquities and alive with bats. A shot from a saloon pistol caused the death of seven of these perverse dispositioned cheiroptera, who beat their ill-omened wings in our faces, clung to the brims of our wide-awake hats, and were slaughtered by swarms in a general "battue.' This, one of the great tombs of *Assaseef*, was covered far underground with sculptures in relief. We were lowered by ropes into chambers beneath, still sculptured, until at length, heartily tired with bats and bad air we returned once more to the light of heaven

"In a rock cavern, where candles burnt blue in the stifling heat, we succeeded in tackling an Egyptian lady, who was carefully brought to light and solemnly unswathed. Her chignon of curly black hair, together with a foot of remarkably high instep, are still to be seen in the cabinet of a collector. In this tomb we found a few blue porcelain figures of mummies represented in the character of Osiris, their great judge and god of the dead, with flail and scepter, the symbols of retribution and power. As we retreated with our female mummy attached to a cord, a large portion of the roof fell in—for the tomb was simply rough hewn in the rock—and the sand, closing in on the mouth of the cave, all but barred our exit, and would probably effectually shut the entrance to future travelers who might wish for a specimen of early embalming. The Arabs in the neighborhood have so little respect for their ancestors that they are in the habit of using them as firewood. The cloth, soaked in bitumen, burns very readily, and the body gives out a good flame, which is found useful for cooking, when there happens to be anything to cook. This great custom of the modern Thebans puts the funeral institutions of the Romans completely into the shade, for although the Romans burnt their dead, they never thought of turning them to any account for culinary purposes,"

Again, on Belzoni's tomb, which is perhaps the noblest of all, we find the best and richest coloring. "The four square pillars of the first hall beyond the pit are decorated like the whole of the walls. On them are painted female figures, nobly proportioned, and of great beauty. Their robes of blue, purple and scarlet colors, fastened with gold clasps, are magnificently embroidered with ornaments, and their heads crowned with elaborate tiaras of enameled work. In this chamber Horus, son of Osiris, the deity of good, is seen crushing beneath his feet and stabbing with a spear, the giant serpent of evil, Aphophis, with his numberless folds and human head, proving to one's mind how widely spread are all the numerous primitive traditions."

The head of this mummy is probably that of one of the ancient aristocracy of Thebes. I judge so from the evident care which has been taken in its preparation. From the general contour of the head, I have come to the conclusion that it is that of a female. The forehead is somewhat receding and narrow; face rather projecting, of pure Egyptian type, viz., head small, low and narrow. The actual features cannot be seen, as they are covered, as it were, with a mask. Linen bandages are placed round the neck like an old fashioned white neckcloth. These are then brought up from the back of the head in a figure-of-eight fashion, and are made to envelop the whole back of the head. This is the work of a very clever

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artificer. The bandages are made of linen of about the same substance as those now used at St. George's Hospital. Underneath this linen mask can be plainly seen the outlines of the face; the pupils of the eyes are marked in with a black spot, and the eyelashes (also marked in) are united together at the external part of the eyes, the lines being prolonged on to the cheeks. The eyebrows unite over the bridge of the nose, and follow the contour of the prolonged eyelashes below.

About an inch above the eyelashes we see a narrow cord, or band of linen —a sort of fillet, which, starting at the back of the neck, is brought up in a graceful curve over the ears, and again to the back of the head.

This mummy, I am delighted to say, wears a wig. We found the whole head covered with what at first sight appeared to be rolls of hair, but which, on examination, turned out to be imitation hair formed of little curl-like rolls of a material which looks like fine canvas. The rows forming this wig are arranged in three tiers, one above the other, and gracefully overlapping each other. The lowest tier begins from the top of the ear and runs almost straight across the forehead. It is not at all unlike the fashion of hair as worn by some ladies of the present day. To try the effect, I have put a modern smartly-trimmed hat on the head of this Egyptian lady. I see that the fringe of the hair is the same as the fringe of the present time. On the whole, there is a little more *chic* about it. The tips of the ears and the lips are covered with a dark red pigment, which I find is soluble, and comes off with the finger, even after the lapse of so many thousand years. Another idea. I have washed a side of the mummy's face with warm water and a sponge, and, having again put on the smart Regent Street bonnet, am more convinced than ever that this is the head of a lady. The damping of the linen cloth has given quite a different and almost life-like appearance to the features; altogether, the lady looks very good-natured and smiling.

This application of moisture brings out the fact that the red material is not only on the ears, bnt also at the corner ot each eyelid and on the nose. I cannot make out what has become of the lady's hair. I therefore dissected off some of the bandages of the back of the head, and then identified the bitumen which surrounds the skull. In this I find several little short hairs. I therefore consider that the head was shaved in order that the wig might fit the contour of the head gracefully, which is certainly does. Wigs appear to have been commonly worn by the Egyptians. In the British Museum there is a most splendid wig, Also, in another case, articles of dress and appliances for the toilet, such as a leather dress, a linen shirt, and a box to hold clothes, combs, hair-pins, ointment vases, and apparatus for painting the eyes with stibium, bronze mirrors, and a collection of shoes and sandals.

I cannot find any marks of gold about this Theban lady's head. It appears, however, not to have been an uncommon practice to gild the nails of the fingers and toes of female mummies. I have in my collection the foot of a mummy, on the sole of which there are very substantial traces of gold. It may interest our readers to know the mames of Egyptian ladies, which I have picked out from

various sources. They are as follows: Bochoris, Catbti, Tphous, Shepshet. I wonder what was the name of the lady whose head I now possess?

The word mummy is derived from an Arabic word, Mum, signifiying wax. Herodotus, a very great observer, and evidently a great note-taker, has been good enough to record many interesting details relative to the process of embalming as carried out by the Egyptians. It appears that there were professional embalmers, whom the relatives of the deceased consulted as to the style of mummy. "They show the bearers of it wooden models of bodies, painted in imitation of reality. They say that the most expensive of them is His, whose name I will not in such case mention. They exhibit also a second model, inferior to the first, and cheaper than it; and a third, the cheapest of all. After this explanation, they ask the bearers of the dead body after which model they wish it to be prepared, and they, having agreed upon the price, depart." "His" implies Osiris, who was the Jehovah, the great God of the Egyptians. This name was held in the highest awe.

Herodotus then gives us the prescriptions used in the different kinds of mummy making. In the most expensive process, powdered myrrh, and cassia were used. The body then was pickled in a solution of natrum (carbonate of soda) for seventy days. In mummy making, Jew's pitch, *Bitumen Judaicum*, was used. This is nothing more or less than the asphalt now used in making the London pavements. The bandages appear to have been always linen, several feet long, differing, however, in the fineness of texture.

On reverting to the head since it has been wetted, I find that what appeared to be bandages over the face are not so, but simply a linen mask in one continuous piece. This mask has evidently been applied wet to the face, and has been pressed down into the depressions of the features, so that the likeness of the person is apparent. I find also that the nose is considerably depressed on the right-hand side. This is a curious phenomena, for which I cannot account, but in relation with it must be considered a fact that on the left side the head is covered with sand of a reddish color. This may be the sand of the desert.

One of the most perfect mummies I know of is a very old friend of mine. It is that of Horseisi, an incense-bearing priest of Ammon. He is now at the Royal College of Surgeons, Lincoln's-inn Fields.

"Mr. Pettigrew informs us that Mr. Clift, the intelligent conservator of the museum, suspected that there had been a fracture; and upon removing a portion of the scull this was found to have been the case. The occipital bone had been broken, and on the inner surface an exudation, or rather deposition of bone, extending upward of one inch in length, was found to have taken place, thereby marking the process of nature in repairing an injury of the frame."

Besides the head of this Theban lady, Mr. Douglas Murray has given me a mummy crocodile. The sacred animals of the Egyptians were as follows: Cats, jackals, cynocephali, bulls, rams, the ibis, snakes, fish, crocodiles. They seem to have had a special veneration for the crocodile. The reason for this, as suggested by Mr. Douglas Murray, is obvious. Crocodiles must have water to exist.

Water in Egypt is of the highest importance for drinking and watering fields. If the canals were neglected the crocodiles would die. The people, therefore, were kept in order under a superstitious awe for the crocodiles, but it really was an artful dodge of the authorities to keep the water supply of the country in good order. The crocodile is about 22 inches in length. The right fore paw is placed over the right eye; the left fore paw is tucked under the chest. There is an appearance on the lower jaw as though it had at one time been slightly covered with gold. This crocodile was carefully wrapped up in linen cloth. My friend, Mr. Fred Wiseman, the well-known yachtsman, discovered in the linen bandage which surrounded the crocodile's tail a knot used every day at the present time by yachtsmen. Another interesting specimen found in a mummy tomb is a portion, about two inches square, of some substance which looks like amber. It is not, however, amber: its real nature is unknown. My own idea is that it is adipocere, a substance into which human bodies are not unfrequently converted, as I know so well from the discoveries I made when searching for the body of John Hunter in the vaults of St. Martin-in-the-Fields.

Among the relics brought me from Egypt at the same time with the mummy head are various specimens of old pottery from Dendera and the temple of Kom-ombo; a very beautiful alabaster pot from one of the tombs at Thebes; also a very curious natural formation in flint from the mountains which flank the Nile. Two portions of papyrus plants were also in the parcel. From the word papyrus our English paper is certainly derived. The papyrus used to be made from the stalk, which was divided longitudinally into long thin flakes. These were placed side by side, and others put across them to strengthen and unite the papyrus. There are also numerous specimens of Nile fish collected at the same time with these other Egyptian curiosities. Among these are some heads of the large siluris and the head of a fish with some most wonderful lancet-shaped teeth. I cannot sufficiently thank Mr. and Mrs. Douglas Murray for bringing me home these interesting relics, which form a very valuable addition to my collection.—FRANK BUCKLAND, *in Land and Water.*

METEOROLOGY.

MISSOURI WEATHER SERVICE, NOVEMBER, 1878.

BY PROF. FRANCIS E. NIPHER, WASHINGTON UNIVERSITY, ST. LOUIS.

November, 1878 has been warm and dry. At the central station the mean temperature has been 46.4° (normal 42.9°), the extremes being 30° on the 1st and 71.5° on the 6th. Englemann has observed Novembe. temperatures of 0.5° (1845) and 81.5° (1837).

The rainfall has been 1.02 inches—the normal being 2.95. The extreme

November rainfall in 39 years is 0 in 1865, and 11.55 in 1876. Twice in 39 years has the November rainfall been less than during November, 1878. In the State, the rain has been greatest in the southeast, reaching 3.60 at East Prairie (south of Charleston). The entire western part of the State has suffered from excessive drouth. Streams have dried up, and forest and prairie fires have raged. At Forsyth the monthly rain was only 0.08 inches. On the 30th an interesting storm came in from the northwest, covering the northern part of the State with snow. Prof. Lovewell reports this storm as passing Topeka, Kansas, at 7 A. M. Twelve hours later it reached St. Louis. Thunder was observed at Neosho during its progress there.

On the 18th an earthquake was felt over the southern and eastern part of the State, the shock having been felt as far north as Hannibal, Macon and Kansas City. At Glasgow the shock was quite severe. The shock was also felt as far south as Memphis, Tenn. and Little Rock, Ark.

We shall try to collect information for a special bulletin on this subject, and solicit information from any one who can give it. If possible, the time of the occurrence (in local time or the time of some known locality); the direction of vibration (swaying of chandeliers, etc.); and all observed effects should be given. State also how generally it was observed in your locality.

KANSAS WEATHER REPORT FOR NOVEMBER, 1878.

BY PROF. F. H. SNOW, OF THE KANSAS STATE UNIVERSITY.

The warmest November on our 11 years record. Mean temperature 45.87°, which is 7.06° above the average November temperature of the 10 preceding years. The mercury fell below freezing point on only three days, The highest temperature was 72°, on the 5th; the lowest was 22°, on the 8th; range of temperature, 50°. The mean at 7 A. M., was 38.55°; at 2 P. M.. 55.83°; at 9 P. M., 44.52°.

Rain and melted snow, 1.55 inches, which is 0.23 inches below the November average. Rain fell on seven days, Snow fell on the 30th to the depth of two inches. The entire rainfall for the eleven months of 1878 now completed, has been 36.50 inches, which is 3.24 inches above the average for the same period for ten years.

Mean cloudiness, 42 per cent. of the sky, the month being slightly clearer than usual. The number of clear days was 17 (entirely clear 6); half clear, 3; cloudy, 10 (entirely cloudy, 3). Mean cloudiness at 7 A. M., 42.33 per cent.; at 2 P. M., 46.66 per cent.; at 9 P. M., 37 per cent.

Wind.—N. W., 34 times; S. W., 19 times; N. E., 14 times; S. E., 13 times; N., 7 times; S., 3 times. The entire distance traveled by the wind was 11,198 miles, which gives a mean daily velocity of 373 miles, and a mean hourly velocity of 15.55 miles. The highest velocity was 40 miles an hour, on the 27th.

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Relative humidity:—Mean, for the month, 62.6; at 7 A. M., 76.9; at 2 P. M., 40.9; at 9 P. M., 70.2. Greatest, 97.3, on the 10th; least, 18.2, on the 57th. Mean at 7 A. M., 76.9; at 2. P. M., 40.9; at 9 P. M., 70.2. There was one fog—on the 7th.

MEDICINE AND HYGIENE.

MILK AS A VEHICLE OF CONTAGION.

BY ALEXANDER R. BECKER, M. D., BERKELEY, CALIFORNIA.

Among the many questions now agitating the scientific world there is, perhaps, no one of more vital importance than the Germ Theory of Disease; and, up to the present time, at least, the most important application of this theory has been to the so-called zymotic diseases. These diseases are also attracting close attention on account of the fearful ravages caused by them, every year, in our cities, as well as in the rural districts. Any light which can be thrown on their origin and spread must, therefore, be hailed with satisfaction.

There is one source which we think has not been sufficiently insisted upon, although it has attracted more attention in England than in this country; and that is *milk*. How many householders ever think of inquiring where their milk-supply comes from, or what are the sanitary conditions of the farm or dairy whence it comes? In several of the States there are "milk laws;" and some of our large cities have "milk-inspectors," who examine the milk, more or less carefully, for "adulterations." But no care of chemical or microscopical analysis can discover the infinitely more dangerous disease-germs or contagia. If the disease-germs be present in the water which supplies the dairy they will surely get into the milk, either innocently, through the necessary washing of the cans, or wrongfully, through intentional "watering." Or, if they should be present in the atmosphere, they would naturally be attracted and absorbed by a fluid so rich in nitrogen and water; which would also afford them a pleasant resting-place until, by its consumption, they could reach an appropriate nidus.

In England, several epidemics have been directly traced to the milk which came from dairies where the water-supply was found to be contaminated. In one case—at Bolton—forty-seven out of fifty families supplied from the same dairy were smitten with typhoid fever. On examination, the water-supply of this dairy was found to have been polluted by the dejections of a typhoid-fever patient.*

When we remember the utter carelessness which prevails in the country generally, on the subject of drains and privies, and their position relative to brooks

* See paper by Dr. John Dougall, Medical Officer of Health for the Burgh of Kinning Park, Glasgow; *Glasgow Medical Journal*, May, 1873, p. 312 Also, "Eighth Annual Report of the State Board of Health of Massachusetts," 1877, p. 122.

and wells, we must stand appalled at the resultant danger. And here we find a very probable origin of many of our city epidemics. Moreover, we see that, in order to make our milk-laws and milk-inspection effective, they must be extended so as to cover *all* milk-farms, with their dairy buildings, systems of sewerage, and water-supply. This would of course be very unpopular with the farmers, and would entail considerable expense, as it would largely augment the labors of the State Board of Health.

But, if the people could be brought to see (1) the enormous death-rate from the contagious fevers; (2), the great danger of drinking milk containing contagia; and (3), the strong probability of such contamination of their milk-supply, owing to their ignorance and carelessness of dairymen, public opinion would soon demand the passage and strict enforcement of such preventive measures.—*N. Y. Medical Journal.*

SEVEN GOOD RULES FOR PRESERVING THE EYESIGHT.—Dr. H. C. Angell, in his little book on "How to take Care of our Eyes," recently published in Bosion, gives the following rules to be carefully observed by all persons who have a tendency to weakness of sight, or who experience unusual fatigue of the eyes in reading or other occupations requiring close use of the eyes:

1. Cease to use the eyes for the time being, and look away from the work when sight becomes in the least painful, blurred or indistinct. After perfect rest for a moment or longer, work may be resumed, to be discontinued as before when the eyes feel again fatigued.

2. See that the light is sufficient and that it falls properly upon your work. Never sit facing it. It is best that the light should fall upon the work from above and behind. Failing this, it may fall from the side. Never use the eyes at twilight. Any artificial light for the evening is good if it is brilliant enough and steady. When artificial light is at all painful, it is safer to read or write only during the day.

3. Never read in the horse or steam cars. It requires too great an exertion of the accommodative power to keep the eyes fixed on the letters.

4. Never read when lying down; it is too fatiguing for the accommodative power. Many a tedious case of weak sight has been traced to the pernicious habit of reading in bed after retiring for the night.

5. Do not read much during convalescence from illness. Before the muscular system generally has recovered its healthy tone, we ought not to expect the muscles of accommodation to bear the continuous use to which they are subjected in reading or writing. We cannot be sure that the delicate muscles of the eye are in a condition to be used until the muscles of the leg and the arm have regained their strength and firmness.

6. The general health should be maintained by a good diet, sufficient sleep, air, exercise, amusement, and a proper restriction of the hours of hard work.

7. Take plenty of sleep. It is a sovereign balm for those who suffer from weak sight. Retire early, and avoid the painful evening lights. Ten hours sleep for delicate eyes is better than eight.—*Boston Journal of Chemistry.*

XUM

THE PRIME OF LIFE.—Between the ages of forty-five and sixty a man who has properly regulated himself may be considered in the prime of life. His matured strength of constitution renders him almost impervious to an attack of disease, and experience has given soundness to his judgment. His mind is resolute, firm and equal; all his functions are in the highest order; he assumes mastery over his business; builds up a competence on the foundation he has laid in early manhood, and passes through a period of life attended by many gratifications. Having gone a year or two over sixty he arrives at a stand-still. But athwart this is the viaduct called the turn of life, which, if crossed in safety, leads to the valley of "old age," round which the river winds, and then beyond, without boat or causeway, to effect his passage. The bridge is, however, constructed of fragile material, and it depends how it is trodden whether it bend or break. Gout and apoplexy are also in the vicinity to waylay the traveler, and thrust him from the pass; but let him gird up his loins and provide himself with a fitter staff, and he may trudge on in safety and with perfect composure. To quit metaphor, "the turn of life" is a turn either into a prolonged walk or into the grave. The system and powers having reached the utmost expansion, now begin either to close like a flower at sunset or break down at once. One injudicious stimulant, a single fatal excitement, may force it beyond its strength, whilst a careful supply of props and the withdrawal of all that tends to force a plant, will sustain it in beauty and vigor until night has entirely set in.—*Sanitarian.*

LIFE WITHOUT AIR.

The *Journal fur Prakt. Chemie* gives a detailed account of experiments instituted by Professor Grunning, of Amsterdam, to settle the question as to the ability of bacteria to exist in media free from oxygen, a doctrine which has been warmly advocated by Pasteur. He made use of ferrocyanide of iron as an exceedingly delicate test for oxygen, and by the use of this re-agent detected oxygen in the apparatus and media which are generally employed for cultivating micro-organisms, and which have hitherto supposed to have been free from air. The experiments consisted in inclosing in glass tubes easily decomposable substances, such as raw flesh, green peas, etc., infecting with a drop of a mixture of decayed peas and white of egg, which contains nearly all varieties of bacteria, and closing the tubes by fusion after carefully freeing entirely from oxygen. The sealed tubes were exposed to a temperature of about 100° Fah. A considerable number of such vessels have been kept two years without the contents having suffered any change, as, on opening, they were found to retain their original freshness. The result of these experiments appears to show, contrary to Pasteur's views, that, by the exclusion of oxygen, bacteria are completely destroyed, and putrefaction, being arrested, does not continue afterward on the admission of filtered air free from bacteria.

FUMIGATION IN ASTHMA.—At a meeting of a medical society in Philadelphia, Dr. W. M. Welch called attention to his treatment of asthma by fumigation. The powder to be burned is composed of two and one-half parts of nitrate of potassium, one-half part of belladonna, and five parts of powdered stramonium leaves, intimately mixed with a small proportion, say one-half part, of pulverized white sugar, the latter being added to prevent the compound from burning too freely. The saltpeter may be disolved in just enough water to make a saturated solution, which is mixed with the leaves, and subsequently dried into a coarse powder, and sugar added. A small quantity is placed on a brick or tin plate and ignited, when it burns, giving off a cloud of smoke. He had occasionally spread sheets over a clothes-horse for the purpose of confining the fumes, and had obtained very satisfactory results during paroxysms of asthma.—*Boston Jour. Chem.*

BOOK NOTICES.

ORATORY AND ORATORS, by William Mathews, LL. D., Chicago; S. C. Griggs & Co., 1879. pp. 456. 12 mo. $2.00.—For sale by M. H. Dickinson.

Professor Mathews is one of those fortunate writers who, despite their rapidity of production, can maintain their *prestige* with readers of all classes. He produces at least one book a year, but instead of palling upon the tastes of the public, each successive work is greeted with increased enthusiasm.

The above named volume has been promised by the publishers for several months past, and it is but justice to them to say that in every respect it comes up to the expectations excited by their announcement.

The arrangement of the work is natural and logical, and the general treatment of the special topics, admirable. While the style of the writer is easy and graceful, it is evident that prodigious labor has been expended in examining, comparing and selecting from many and various sources the materials used in illustrating the many points made. Beginning with a brilliant chapter upon The Power and Influence of the Orator, he holds the reader's close attention while he discourses ably and eloquently upon the Qualifications of the Orator, the Orator's Helps and Trials, and the Tests of Eloquence. To these and kindred topics he devotes eight chapters, full of most valuable and practical suggestions to speakers of all classes, young and old, and teeming with apt illustrations and appropriate quotations. The remaining six chapters are devoted to vivid sketches of the principal political, forensic and pulpit orators of England, Ireland and America. These sketches are exceedingly well done, and, aside from their fitness as illustrations of the subject in hand, are most interesting and life like portraitures of most of the distinguished orators of this and the preceding century.

It is a book that will please and instruct all, but at the same time it is one that is difficult of description, and requires perusal to be appreciated. Suffice it to say that it is a most fascinating work, based upon extensive and accurate knowledge, and built up with most attractive art and skill.

ZOOLOGY OF THE VERTEBRATE ANIMALS, by Prof. Alexander Macalister, M. D.; Henry Holt & Co., N. Y., 1878. 12 mo. pp. 134. 60 cents.—For sale by M. H. Dickinson.

This is another of the excellent series of *Hand-books* in various departments of science now in course of publication by Henry Holt & Co. While they are small and brief works, they are written by authors of profound learning and established reputations for especial familiarity with the subjects they treat, and are just what is needed by readers who have not the time necessary to cull the desired knowledge from the extensive and exhaustive works of technical writers.

The little book under consideration may be read in two hours, and yet it is the careful and precise work of a distinguished professor of zoology and comparative anatomy in the University of Dublin, revised with especial reference to American readers by Prof. A. S. Packard, Jr., one of the ablest and most skillful naturalists in the United States, so that its teachings may be implicitly relied upon as the latest and most exact revelations of science. It gives in less than one hundred and fifty pages a comprehensive and systematic account of the leading characters of the vertebrata in a style devoid of technicalities and adapted to the general reader.

The whole series will comprise similar brief works on architecture, art, astronomy, physical geography, botany, chemistry, literature, music, physics, political economy, &c., making, as a whole, a most valuable pocket library for students in school, or for those older persons whose knowledge on such subjects needs a little jogging and revising.

THE BLESSED BEES, by John Allen; G. P. Putnam & Son's, New York, 1878. 12 mo. pp. 170. $1.00.—For sale by M. H. Dickinson.

When Pausanias, some 1700 years ago, described in glowing terms the bees and honey of Hybla and Hymettus, it is reasonably certain that he did not foresee that in 1878 the citizens of the United States would be improving their honey, and "Italianizing" their honey-makers, by introducing among them the descendants of those self-same bees of Hybla. Yet such is the case, and we prosaic time serving Americans, now eat, without remark, identical sweets with those produced from the flowers which perfumed the air and bedecked the craggy sides of Mount Hymettus.

The work before us is an account of a year's work with bees in Michigan, during which time, upon an outlay of $1,600 (of which $830 was a permanent investment,) a clear cash profit of 360 per cent. was made, or, counting gain in stock by natural increase, 454 per cent.! These are surprising figures, but to any one who reads the book they are made plain as daylight. In addition to this the whole subject of bee-keeping is fully, clearly, and entertainingly discussed. While every man cannot become a successful bee raiser, it is made quite evident that there is "money in it" to careful, painstaking persons, who will pursue the business intelligently and faithfully, and to such persons we can conscientiously recommend Mr. Allen's little work.

HISTORY OF THE CONFLICT BETWEEN RELIGION AND SCIENCE, by John William Draper, M. D., LL. D ; D. Appleton & Co., N. Y. Eighth edition. pp. 373. $1.75.

This is the twelfth number of *Appleton's International Scientific Series*, and one of the best of the list. Professor Draper, as usual with him, exhausts the whole subject, so far as history is concerned, and while all may not accept his conclusions, no one can refuse to admit his facts and the careful and untiring research manifested in every chapter. He has spared no pains in collecting materials. Grecian, Roman, Egyptian, Jewish, Mohammedan and Hindoo history have all been made to contribute to this discussion, and no one, no matter what may be his particular beliefs, can lay the book down after reading it, without a consciousness of having acquired additional information and an enlarged liberality of ideas upon the conflict between religion and science.

The work is for sale by M. H. Dickinson of this city, whose stock of scientific books is really wonderful in its completeness; equal to any metropolitan establishment anywhere. More recently, to meet the demand, he has added scientific instruments, such as microscopes, field and opera glasses, engineer's cases, globes, graphoscopes, &c. Of rare specimens of the book-maker's art, we have never seen excelled a ten volume edition of Shakespeare, bound in Russia leather, copiously annotated and printed in the most readable type imaginable. It is a gem of itself, but is surrounded by the most elegant works, displaying the rare skill of the Harpers, Appletons, Osgoods, Houghtons and other artists in bibliopegia. At the same time Christmas goods in the most ornate and ingenious styles, from a superb jewel case to a steam doll baby, load the counters.

SCIENTIFIC MISCELLANY.

THE MEAT MINES OF SIBERIA.—It has often been stated that the inhabitants of Polar Siberia feed their dogs on mammoth meat preserved in nature's ice house and sliced off at the convenience of the dogs. How these tropical animals came to be so near the pole is an unsolved problem of the earth's history. There are various theories intended to explain the conditions, but none of them are quite convincing. The most reasonable one is, that countless years ago there must have been a sudden change of temperature at the poles from torrid to frigid. The animals were caught out of their latitude, frozen and buried in ice. A recent traveller in Siberia relates that happening to drive in a sledge along the base of one of the monstrous ice cliffs that overhang the estuary of the River Lena, he came upon a pack of wolves devouring the frozen flesh of a mammoth. The breaking away of a portion of the cliff had exposed the monster pile of preserved

meat, and at the hands of nature the wolves were helping themselves. So nature brings recompense for her freaks and takes care of her own. The meat mines of Siberia have not been developed, and no one knows what riches they may contain, or how they may yet be utilized in the economy of the world. The search may discover the delicacy of "filet de mammoth" warranted fresh from Siberia. —*London Jour. Applied Science.*

EDITORIAL NOTES.

AT the December meeting of the Kansas City Academy of Science, Tuesday the 31st inst., a paper upon "Foot-prints of Primitive Thought" will be read by Judge E. P. West, after which there will be a discussion of certain questions proposed by Prof. Greenwood at the last meeting, viz:

1st. Is there any connection between the maxima and minima daily variations of the barometer and the magnetic needle?

2d. It is required to show by a simple mathematical process that the centrifugal force on the earth's surface decreases as the square of the cosine of latitude from the equator to either pole?

THE record of the progress of science for the past month will be read by T. S. Case.

THE Leavenworth Academy of Science, which is in a well organized and flourishing condition, held its regular monthly meeting on Friday evening, December 1st. A lecture upon the "Spectrum Analysis of the Heavenly bodies" was delivered by Mr. Coleman, which, according to the *Times*, was exceedingly interesting and instructive.

WE have received, through the kindness of Captain Howgate, a number of *fac simile* drawings executed by Eskimo artists, living near Discovery Bay. These sketches represent different views of polar or arctic life, such as seal or walrus hunting, whaling and deer hunting, and show a fair degree of capacity for artistic culture by the natives. He also sent at the same time several copies of photographs taken by Prof. Sherman of the *Florence*, which give a perfect idea of the surroundings and native associates of her officers and crew during the past season.

THE *Popular Science Monthly* for December contains an article by Prof. L. W. Peck upon the subject of explosions from combustible dust, in which he demonstrates that all combustible material when finely divided, forming a dust or powder, will, under proper conditions, burn with explosive rapidity.

THE heaviest snow known for a number of years, for the season, fell in Southern Colorado last month. It was about five feet deep, and fell in less than twenty-four hours, causing much loss of stock and a great deal of suffering to travelers.

THE most tremendous rains have lately been visiting some portions of Europe, and great damage has resulted from the floods.

THE American Public Health Association, after a careful investigation of the yellow fever question in all its bearings, conclude that its transmission between points separated by any considerable distances, appears to be wholly due to human intercourse, and that a rigid quarantine, amounting to absolute non-intercourse, is the only really successful measure of prevention which has been adopted.

An electric hand lamp for domestic purposes has been invented in Philadelphia, which only weighs fourteen ounces, runs by self-contained clockwork, and is guaranteed to run for six hours, giving the light of *nineteen hundred candles*, at the cost of half a cent an hour. It will be placed on the market next spring at $6.

The *London Chemical News* publishes a note addressed by Prof. Norman Lockyer to the French Academy of Sciences, Oct. 28th, respecting the compound nature of the chemical elements, which is as follows, and seems to be the sole basis of the remarkable and sensational statements in the newspapers regard the discovery:

"Reasoning from analogies furnished by the behavior of known compounds, I have discovered that, independently of calcium, many other bodies hitherto considered as elements, are also compound bodies," and remarks: "In communicating this note to the Academy of Sciences, at the meeting which was held on October 28th last, M. Dumas observed that it was the result of three years' assiduous research, in which Mr. Norman Lockyer has, with the greatest care, compared the spectra of the chemical elements with the solar spectrum and other luminous celestial bodies. In the private letter to M. Dumas, accompanying his note to the Academy, Mr. Lockyer announces that he will shortly send the photographs and other details necessary, which will carry conviction to the minds of the members of the Academy."

Early last spring we sent a specimen of what was regarded here as a very rare fish to Prof. Spencer F. Baird, Secretary of the Smithsonian University, for identification. He pronounced it a Burbot, or *Lota Lacustris*. In the December 1st number of Cassino's *Science News*, we find an engraving of the *Lota*. and a careful description by Dr. Bean, who says that it may be recognized by its resemblance to the eel, and that among its poplar names are those of eel pout, and chub-eel, and mother of eels. He also says that the specimen from Kansas City represents the most southern of any in the National Museum collection, and asks that specimens be sent to Professor Baird, from all localities, except the Great lakes and those of Western New York, with all possible information relative to their habits of life, diet, appearance of the young, &c.

A bronze statue of Humboldt was unveiled with appropriate ceremonies on the 24th inst. in Tower Grove Park, in St. Louis. It is the gift of Mr. Henry Shaw, a prominent naturalist of the city, who has for many years devoted himself to science and art, and to whom St. Louis in indebted for many liberal deeds.

Professor Fitzpatrick, Superintendent of the Leavenworth Public Schools, in his monthly report to the Board of Education, advocates the half-time plan for all the lower grade scholars, and adduces the example of Providence, Cleveland, Detroit, Boston, Chicago, Kansas City, &c., in its favor. This system is fully established in the schools of Denmark, Switzerland, and England, and gives better results all around than the old plan of full day sessions for all scholars alike. In Lawrence it has been adopted for all grades in all the public schools.

W. J. McGee, in an essay read before the American Association for the Advancement of Science, claims that the most trustworthy means of distinguishing between the crania of Mound Builders and those of modern Indians, is the greater relative size of the posterior molars, or the "wisdom teeth," in both jaws of the former than in those of the latter. Also by the degree of development of these teeth in young subjects, it having been much earlier in the Mound Builder than in the later man.

We are indebted to the *Phrenological Journal* of New York, for the electrotype of Prof. Newcomb which illustrates this number. This journal is the leading one of its class in this country, if not in the world, and its publishers are always courteous and obliging to the fraternity.

PROF. T. J EATON furnishes the following analysis of Kansas river water from the hydrant near his drug store:

	GRAINS.
Total Solids per Am. gal	29.769
Residue after Incineration	28.030
Dissipated by heat	1.739
Silicic Oxide.	.002
Calcic Carbonate	13.202
Magnesic Sulphate	3.100
Sodic and Potassic Carbonate. . . .	3.189
Aluminic Sulphate	1.895
Sodic Chloride	6.132
Iron trace Potas. Sulphate trace Loss	.510

This is, compared with the drinking water of other cities, quite pure, and far within the limit of "potable waters," which is about 50 grains of saline constituents to the gallon. The amount of organic matter, a little more than a grain and one half to the gallon, is far less than is generally believed.

ON the 7th inst., Prof. Arthur Lakes, of the Colorado School of Mines, dropped in and made us a brief visit. He was on his way to New Haven to assist Prof. Marsh in classifying and arranging the fossil remains of various saurians exhumed by him last season, and sent to the cabinet of Yale college. He will be absent about six months and in the mean time will favor the readers of the REVIEW with an occasional descriptive article.

DR. VAN EMAN, having been appointed by the Medical Society of this Congressional district to examine into and report upon the general condition of our public schools, made to that body, on the 5th inst., a full statement of the attendance, ages and classification of scholars; sanitary condition of the school rooms and out-buildings, including seating, ventilation, heat, light, water, and time occupied daily in study. On the whole the report is very flattering to the management of the schools; the only fault found being with the lack of room for so many pupils, which can not be avoided by the Board, the height of the seats in the lower grade rooms, which can easily be remedied and which should be attended to at once; the deficient supply of fresh air in some of the rooms, based on measurement, which is in some respects an unreliable test, and the quality of the drinking water, which is supposably that of the Kansas river, as an analysis of that water by Prof. Eaton (quoted in another place) is given at the conclusion of the report. Our own judgment is that the cistern water, which is, in fact, used at most of our schools as well as the homes of the children, contaminated as it is by the coal smoke, dust and foul atmosphere of the city, filled with effete organic matters, is far more baneful to the consumer than Kaw water with the constituents found in it by Dr. Eaton.

REV. NOAH PORTER, D. D., Prest. of Yale College, prepared and had read before the Victoria Institute, in London, in the latter part of November, a paper entitled "On Science and Man, with Special Reference to Prof. Tyndall's Late Address." It is an admirable reply to Prof. Tyndall, and we will present it to our readers next month entire.

JUST as we close this number, (December 13th,) the heaviest snow storm remembered in this locality, is upon us, already the depth of the snow is believed to be fully 18 inches on a level, though it is so badly drifted as to almost defy measurement, and the fall continues.

WE learn from the Junction City *Union* that an ancient mound, about six miles from the city, was explored on the 28th of November and a quantity of human and other bones and some small fragments of pottery exhumed. This, taken in connection with the mounds near Ft. Leavenworth, shows that the belief which has hitherto generally prevailed, that no traces of the Mound-Builders exist west of the Mississippi river, is erroneous; and it is probable that as the subject is more thoroughly investigated, it will be found that a line of mounds exists all the way to the Gulf, as in the middle States. We shall publish the article in full in our next issue.

THE *Supplement* to the *Popular Science Monthly* will be discontinued henceforth and the *Monthly* itself increased in size, to make up for it, without increase of price.